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ABSTRACT

Investigators applied the techniques of precision teaching (systematic arrangement of instructional cues, the technology of programed learning, careful management of reinforcement contingencies, and continuous measurement of performance) to improve the academic performance of disadvantaged children who had been labeled mentally retarded. The program also aimed at developing an effective and replicable reading and math program incorporating principles of precision teaching and errorless learning procedures. The project was organized into a 2 year program with experimental and control group classrooms. Analysis of the Wide Range Achievement Test results showed that mean grade gains in reading and math were approximately three times higher for the experimental classes than for the control groups. The experimental classes returned eight of the original 24 students to regular classes, while the control classes returned none out of a possible 24 students. Results were thought to confirm the hypothesis that a high percentage of children from an economically depressed area are labeled mentally retarded for socio-environmental reasons and that such children are capable of acquiring basic skills given a learning environment which maximizes pupil performance. Presentation procedures, academic materials, and evaluation and contingency management procedures were explained in detail. (GW)

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Project No. 572167
Grant No. OEG-0-9-572167-4270(032)

Investigation of Systematic Instructional Procedures to Facilitate Academic Achievement in Mentally Retarded Disadvantaged Children

Dr. Norris G. Haring
Director

University of Washington
Experimental Education Unit
Child Development and Mental Retardation Center
Seattle, Washington 98195

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INVESTIGATION OF SYSTEMATIC INSTRUCTIONAL PROCEDURES TO FACILITATE ACADEMIC ACHIEVEMENT IN MENTALLY RETARDED DISADVANTAGED CHILDREN

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Laurence Maddux	Project Coordinator
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Experimental Education Unit
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Seattle, Washington 98195

September, 1971

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ACKNOWLEDGMENTS

The planning, implementation, evaluation and subsequent consolidation that gave the Project its final form have been cumulative tasks, some more taxing than others, some less rewarding, and many which at the time of performance seemed less than related to the final goal of perfecting more effective and efficient instructional systems.

The Experimental Education Unit staff received unlimited cooperation and support from the Tacoma Public School System. For this, special thanks are extended to Dr. Angelo Guidrone, Superintendant of Schools; Dr. Ralph Baird, Administrative Assistant, Special Education; Mr. Herman Sowell, Supervisor of the Program for Retarded Children; John Piper, the Principal of Lister School; and Alvin Moffat, the Principal of McCarver School. We especially appreciated the patience, hard work and enthusiasm of the two Special Education teachers assigned to the Project, Mary O'Leary and Susan Soli. Their diligent collection of data and implementation of phase changes transformed the original goals of the project into a viable reality.

Norris G. Haring
Laurence Maddux
David A. Krug

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INVESTIGATION OF SYSTEMATIC INSTRUCTIONAL PROCEDURES TO FACILITATE ACADEMIC ACHIEVEMENT IN MENTALLY RETARDED DISADVANTAGED CHILDREN

Title of Project: Investigation of Systematic Instructional Procedures to Facilitate Academic Achievement in Mentally Retarded Disadvantaged Children

Project Director: Dr. Norris G. Haring
Project Coordinator: Laurence Maddux
Assistant Project Director: David A. Krug

ABSTRACT

Purpose

The primary objective of the project was to extend the principles of instruction to promote advancements in the management of educational problems presented by children classified as mentally retarded. The second objective was to develop an effective and replicable reading and math program, incorporating these principles in instruction and errorless learning procedures to maximize pupil performance. Specifically, the investigators intended to meet the following objectives:

1. To establish and demonstrate systematic instructional procedures which facilitate efficient development of academic skills.
2. To sequence a series of reading and math tasks in an order that enables the child to proceed almost errorlessly toward terminal skill objectives, using materials that are practical for use in regular classroom instruction.
3. To provide feedback and reinforcement for correct responses that facilitate efficient, accurate performance. That is:
   a. to increase the probability of the child's attending to the task appropriately, and
   b. to increase the likelihood that he will persist in the task.
4. To develop students' basic reading skills which include visual, graphic, and auditory responses to:
   a. all English letters; and
   b. all common word parts as introduced in Books 1-12 of the programmed reading materials;
   c. all words programmed in this same sequence of books;
   d. basal readers, word lists, comprehension questions, and independent reading material.
5. To develop sequentially the students' basic skills in traditional and new math.
6. To increase the rates of accurate responding in reading and math to grade level.
7. To determine what modifications, if any, must be made in the total program in order to bring each child's skill to criterion performance. That is:

a. To determine what modifications, if any, must be made in the sequence of cues (instructional material); and

b. To determine what modifications, if any, must be made in the types and arrangements of reinforcement used.

8. To place the child in the regular classroom once his reading and math skills have reached criterion performance in the special classroom.

In addition, the investigators intended to follow the progress of the students once they returned to regular classrooms in order to:

a. maintain the students' skill levels in math and reading and their rate of performance;

b. provide follow-up assistance to the students and their teachers; and

c. continue to investigate the conditions that can change any error patterns that had been established or were not removed earlier.

Although these follow-up objectives have not yet been accomplished, they provide the basic topic and the materials for the doctoral dissertation of the Project's Assistant Director, David A. Krug. Mr. Krug will be following the progress of the experimental class students and providing assistance to them and their regular classroom teachers during the 1971-1972 school year. A copy of his dissertation, in which the follow-up data are reported, will be sent to the Bureau of Education for the Handicapped.

Method

The project was organized into a two-year program with experimental and control group classrooms. Children in the experimental classrooms received reading and math instruction under systematic procedures, while children in the control classrooms received programs specified by the teachers and substantiated through periodic observation.

In the experimental classrooms, a multiple baseline analysis was conducted to determine and demonstrate that particular reinforcement variables introduced to change rates of performance were in fact the variables that changed performance. This single N design required that one treatment variable be introduced at a time. Child performance was precisely measured, recorded, and evaluated, and reinforcing consequences for correct responses to academic tasks were provided systematically. The child was observed and continuously measured in a precise manner before the treatment variables were introduced as well as during the treatment.

Results and Discussion

An analysis of the Wide Range Achievement Test pre-post results for the experimental and control classrooms for reading and math show the following mean grade gains made for the 1970-71 school year:

Experimental classes:

Reading - mean grade gain of 1.35
Math - mean grade gain of 1.61

Control classes:

Reading - mean grade gain of 0.45
Math - mean grade gain of 0.48

Perhaps the clearest indicator of overall improvement in academic behavior was the number of return-to-regular-class placements. The experimental classes returned eight of the original twenty-four students to regular class, while the control classes returned none out of a possible twenty-four.

Conclusions

The original hypothesis of the project was that a high percentage of children from an economically depressed area placed into Educable Mentally Retarded classes are labeled mentally retarded for socio-environmental reasons, and that these children are capable of acquiring basic skills given a learning environment (based on precision teaching) which maximizes pupil performance. The project results empirically confirmed the hypothesis.

Introduction

More than half the children described as having special learning or behavior problems are classified as mentally retarded. Unless these children receive effective instruction, they become an increased financial burden to society. It goes without saying that the personal damage the children endure as a result of ineffective education is as serious a concern as the financial burden.

Research shows that children classified as mentally retarded do develop academic skills if the skills are specifically taught them (Kirk, 1964). Skill development has been most effectively taught to the mentally retarded child through procedures which utilized systematic instructional materials based on scientific principles of instruction (Frey, 1961; Haring & Phillips, 1971, in press; Birnbrauer, Wolf, Kidder, & Tague, 1965).

The investigators of this project were influenced by research on errorless learning, by scientific principles of instruction, and by their 1968 summer experience with culturally disadvantaged children, to believe that a population of children identified as mentally retarded and living in a disadvantaged area could be taught reading and math skills at grade level or above.

Two overall objectives were to be accomplished. The first major objective of the project was to extend the principles of instruction to promote better management of the educational problems mentally retarded children present. The second objective was to develop an effective and replicable reading and math program for mentally retarded children which would incorporate principles of instruction and errorless learning procedures in order to maximize pupil performance.

This report describes and provides the rationale for teacher development of curriculum materials, classroom organization, and measuring and charting of academic behaviors. Replication of the materials described and proper implementation of the procedures will enable a teacher to create a classroom environment in which continuous feedback and assessment of individual learning can be integrated into an effective teaching routine.

Instructional Procedures

Data Collection Procedures

Continuous measurement enables the teacher to effectively monitor student performance on a day-to-day basis, and this monitoring must be continuous if individual needs are to be met. A crucial advantage of continuous measurement is that it gives the teacher basic information on child performance which is necessary to effectively change that child's instructional program. Another advantage is that continuous measurement enables the educator to be accountable for what is occurring in his classroom. In addition to promoting better instruction, continuous data also serve as useful tools for explaining to others the rationale for classroom procedures.

The three tools a teacher must learn to use for taking continuous data in the classroom are the plan sheet, the event sheet, and the six-cycle graph.

The plan sheet (Figure 1) is used as a tool for the development of lesson or teaching plans. The important function of the plan sheet is that it forces the teacher to sort out and systematically organize instructional procedures into specific learning processes which will be of most value to each individual student (Martin & Hulten, 1970).

The event sheet is used in the classroom for the actual recording of collected data. An event sheet packet containing name, date, and curricular programming was placed on each student's desk before each instructional day (Figures 2a and 2b). The event sheet represents some aspects of the child's behavior over a period of time, and in this project the behaviors generally recorded were academic correct and error responses. There are five sheets contained in each event sheet packet. Each event sheet packet represents one day, each sheet of the packet represents one hour, and each line on the sheet represents one minute (Mingo, 1970).

The collected data were recorded on six-cycle semi-log graph paper, (Figure 3) especially designed for recording defined movement cycles (Hulten & Kunzelmann, 1970).

Charting Procedures and Conventions

The essential materials for plotting the rates of observed behaviors are chart paper (six-cycle semi-log graph paper was used on the Tacoma project), a sharp pencil, a rate plotter, and a tool for making plots (a template). (Figure 4)

Six-cycle semi-logarithmic chart paper is produced by the Behavior Research Company, Box 3351, Kansas City, Kansas 66103. On the bottom of each sheet are places for listing the name of the person whose behavior is being charted, the name of the teacher, and the movement cycle (write letters, say words, etc.) which is being charted. The vertical sequence of numerals on the left-hand side of the page indicates the number of movements per minute, the horizontal sequence across the bottom of the page represents successive calendar days, and across the top are listed letters (M, W, F) to indicate days of the week. (Figure 5)

When plotting large amounts of data, the process of dividing the movements by time is time consuming. Much of this time can be saved by using the rate plotter (Figure4), a transparent plastic strip which functions as a slide rule (Hulten & Kunzelmann, 1970). When using the rate plotter one locates the number of movements (the dividend) on the graph paper, and then aligns the number of minutes (the divisor) with the dividend. The rate plot (quotient) is then located on the graph paper across from where it says "Plot Here" on the rate plotter. To summarize, the three steps for using the rate plotter are:

Plan Sheet #____ For:_____ Target A___ Pinpointed by: _____ Pupil___ Date_____

M___
D___

MANAGER___
Advisor___

LOCATION:_____ MANAGERS:_____

PROGRAM	PROGRAMMED EVENT	MOVEMENT CYCLE	ARRANGEMENT	ARRANGED EVENT
(Title plus details Time(s) and Dates)	(Presentation Criteria, i.e., who, what, how)	(Record:how long, by whom, how)	(By whom Ratio or Interval)	(Presentation Criteria, i.e.,who, what, how)
Book: Name Publisher level copy date	Who instructs: How is it presented Where is material kept	Name Movement Cycle	Who decides?	Ipt= (1 min, etc.) at what?
If teacher's manual -- a description	How do you teach new skill? (instructions)	How many mins. are you recording Corr. & Error-	Ratio = X resp. per 1 pt; X time per 1 point	Who gives it to him? (how does he receive it?
Time of day	# of responses he must make before raising hand.	How recorded (on event sheet, tape, etc)	Spell out code Contact: who when Cash-ins: when	
Date.	How is he cued for responses or time?	Define: one correct r one error	If errors? If correct?	
Minimum- 1 week per phase	Specify if you will allow pupil to initiate contact			

Instructions given before child is — Actual Event

How To Fill Out A Plan Sheet

Plan Sheet: A Sample

Figure 1

Figure 2a

The one-hour Event Sheet

-(BLANK)-

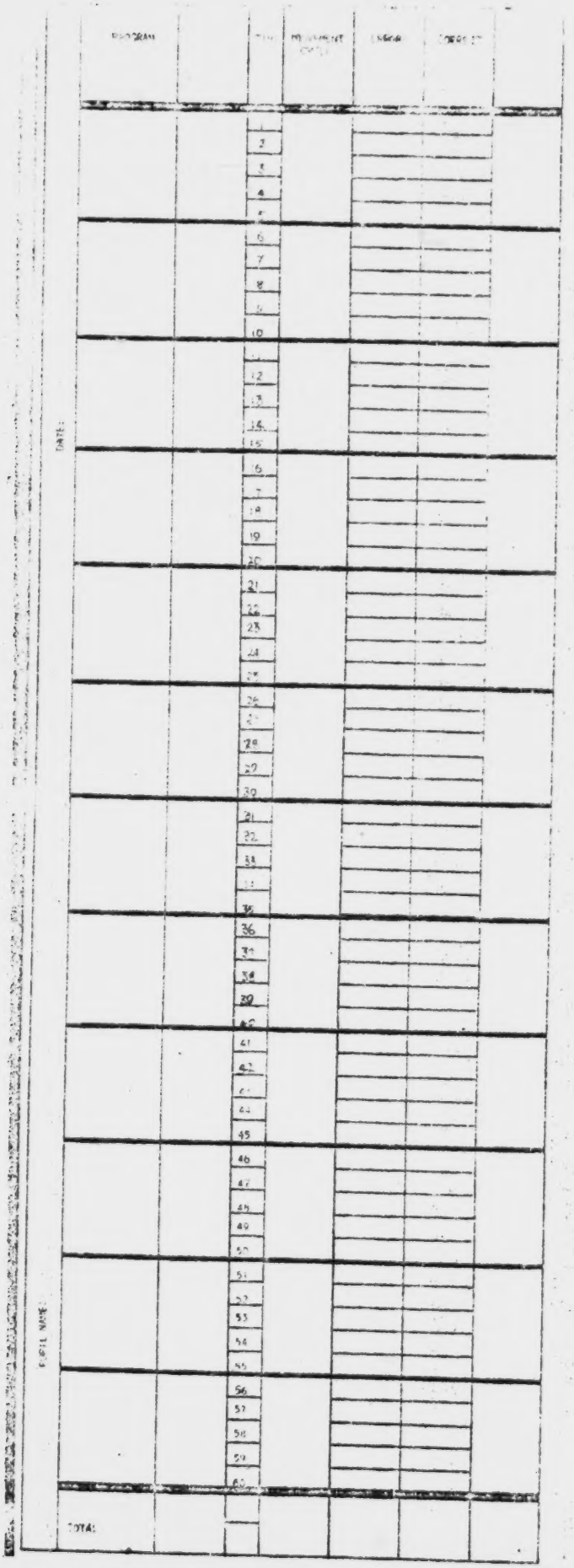
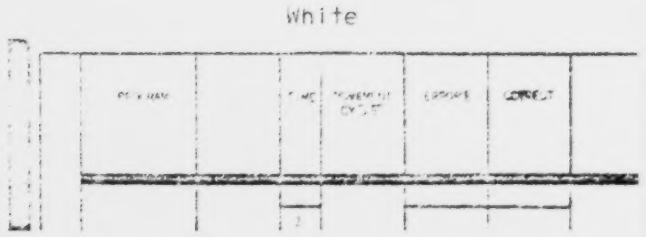
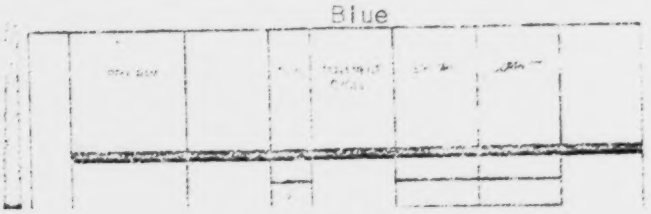


Figure 2b

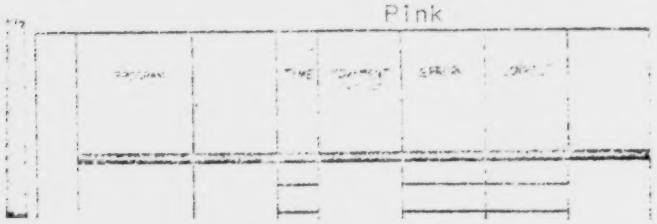
This is an example of a 2:01 - 3:00 Event Sheet Packet



1:01 - 2:00

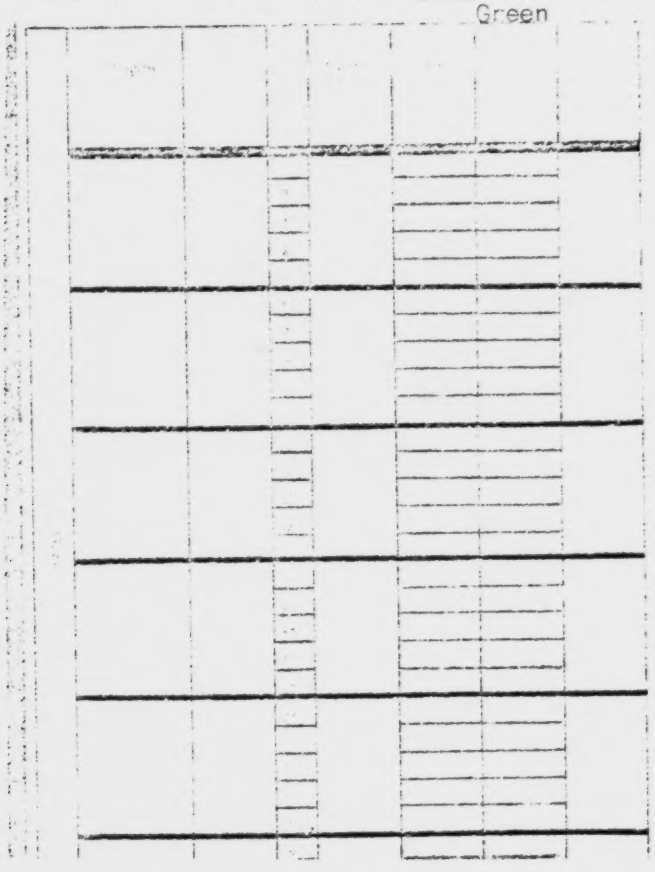


11:01 - 12:00



10:01 - 11:00

9:01 - 10:00



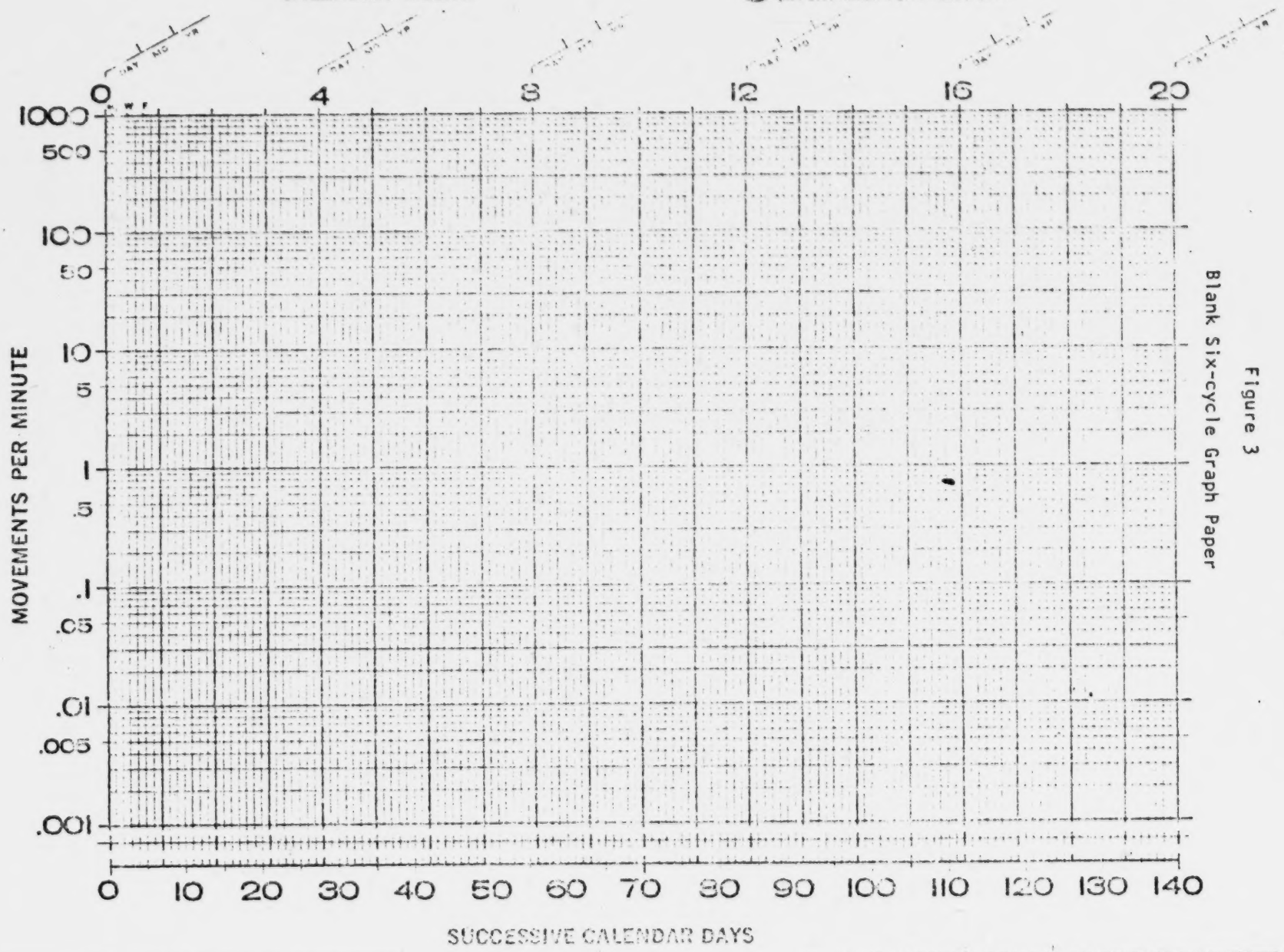


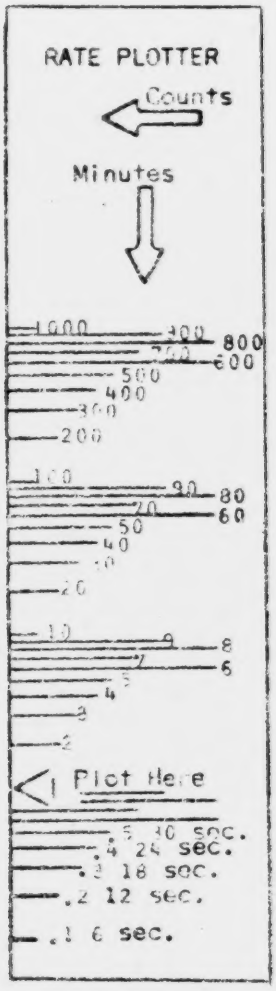
Figure 3
Blank Six-cycle Graph Paper

SUPERVISOR ADVISER MANAGER

DEPOSITOR ACCT LABEL MOVEMENT

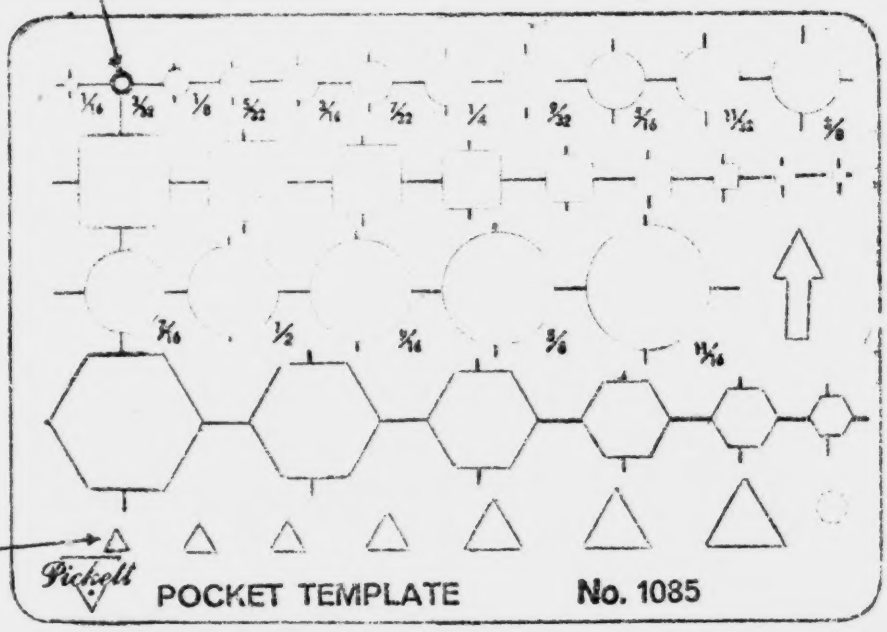
DEPOSITOR

Figure 4
Tools For Plotting



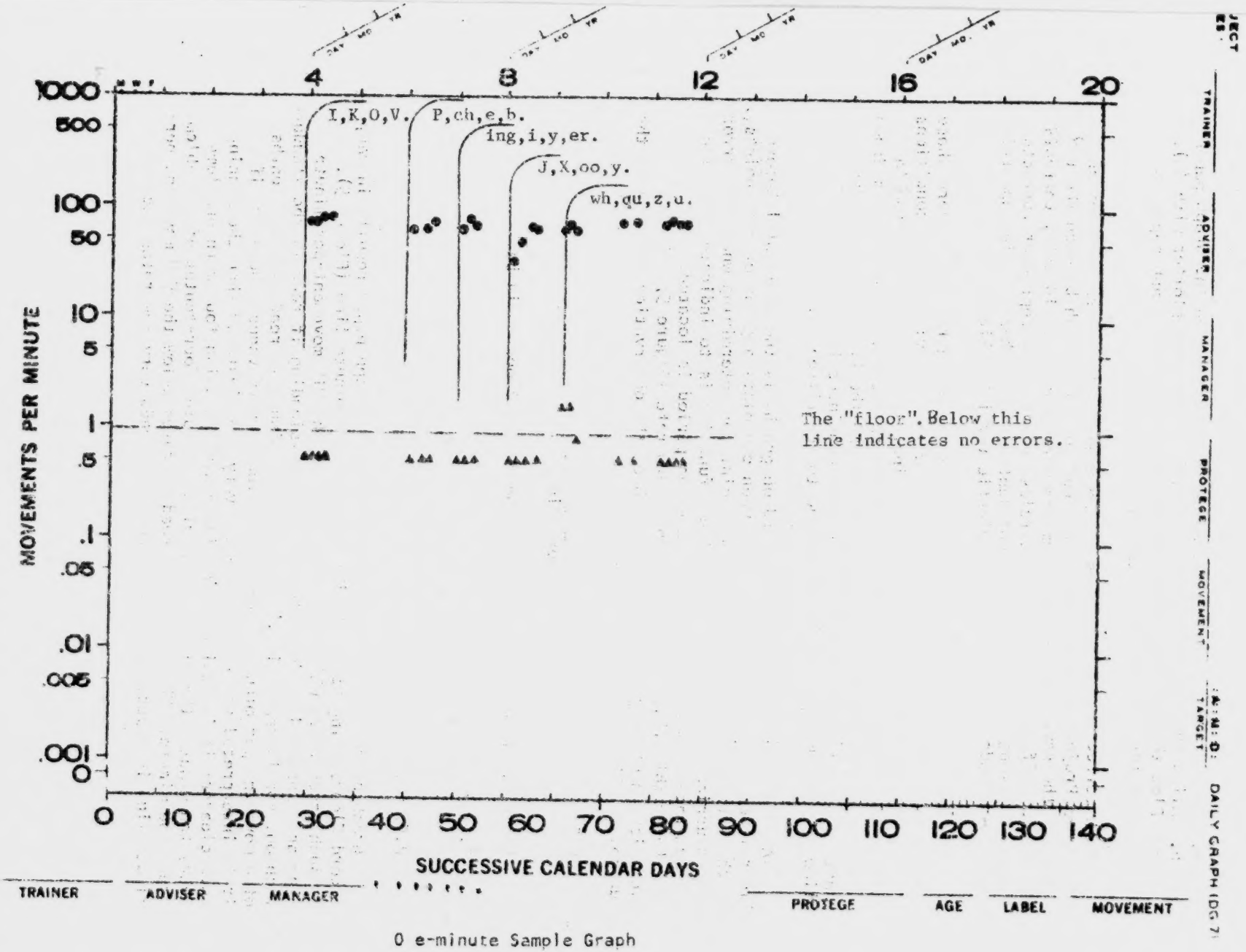
Circle size used on graphs to indicate corrects.

● =correct



Triangle size used on graphs to indicate errors.

▲ =error



0 e-minute Sample Graph

Figure 5

a. Locate the dividend (the number of responses) on the graph paper.
b. Align the divisor (amount of time) on the rate plotter with (a).
c. Plot the quotient (the rate per minute) on the graph paper to the left of the "1" on the rate plotter.

Both correct and error rates of the academic behaviors measured on the Tacoma Project were charted. In order to distinguish between the two plots for the same day different symbols were adopted to identify corrects and errors differentially. Solid circles were used to represent corrects and solid triangles were used to represent errors. These circles and triangles were made with the aid of a plastic template (Figure 4).

The edge of the template was used to indicate on the graph where phase changes were made. A phase change occurs whenever environmental conditions (curriculum, reinforcement, etc.) are manipulated to effect a change in student performance. To indicate the phase change a vertical line is drawn between the last day of the previous phase and the first day of the new phase. The horizontal portion (Figure 5) continues far enough to allow a brief description of the change to be written in.

Another solid line commonly found on graphs is the horizontal Record Floor line. The value of this line, when one plots a group of data points, is that it provides a handy reference point for determining when zero errors are occurring. The Record Floor line's function is to indicate where the minimum rate, other than zero, for a given period is located. Any plot below this line, then, represents zero rate (Figure 5). Record Floor is computed by dividing the length of the observation period into the numeral 1. The formula is:

$$R.F. = \frac{1}{\text{Minutes of observation}}$$

Example: In a 30-minute period the record floor would be:

$$R.F. = \frac{1}{30}$$

$$R.F. = .033$$

Graphing rates of performance on semi-log graph paper results in many Record Floors being below the "1" movement-per-minute line (Figure 5). In such cases rates which are plotted below the "1" movement-per-minute line are expressed as decimals and can be misleading if read in the standard fashion. For instance, if .4 movements per minute is read as "four tenths of a movement per minute," the information is very vague. However, if it is interpreted as "four movements every ten minutes," then the meaning is much clearer; it is easier to imagine a student doing four math problems every ten minutes than it is to imagine him doing four-tenths of a problem every one minute. This method of reading rates below the "1" movement-per-minute line is especially helpful when one reads very low rates such as

.05 which make little sense when read as "five hundredths of a movement per minute." When read as "5 movements every hundred minutes," however, the meaning is quite clear.

Teacher Training

Teacher training began two weeks before the school year with each teacher receiving a packet of materials from the Experimental Education Unit. Most of the first week was spent going over the materials dealing with the plan sheet, the event sheet, and graphing, with some time spent on evaluation and selection of probe materials. During the second week teachers observed classrooms at the Experimental Education Unit where those techniques and materials are in use. Training the teachers in the use of the probes (see probe section) included a discussion of the rationale for the probing process, the presentation procedure, the data collection procedure and the scoring criteria.

Classroom Schedule

Preparation of the daily event sheets for one classroom (12 students) took, on the average, approximately one hour of teacher time and was generally accomplished prior to, or immediately following, the students' daily instruction. The classroom instructional schedule was organized as follows:

8:30 - 9:30 - Regular classroom teacher conducted traditional business--lunch count, attendance count, etc.

9:30 - 10:00 - Each class was divided into two groups of equal size. Group One worked on Distar Reading (Group Say-sounds); Group Two worked on Suppes Math (Write-numbers). Assignment to groups was determined by the student's placement in the Distar Book. One teacher was assigned to each group.

10:00 - 10:30 - Recess. Supervised by the school staff in order to release project teachers for the task of calculating Distar responses for graphing.

10:30 - 11:00 - The 9:30 groups switched tasks.

11:00 - 11:30 - Both groups were in Distar Reading (Write-letters, Say-sounds). While one teacher made Write-letter contacts, the other teacher took one-minute Say-letter, and Say-sound samples (see Appendix). During this time the students sat in a circle (facing out) to provide easy access for the teacher making Write-letter contacts (Figure 6).

11:30 - 12:30 - Lunch. Teachers utilized the lunch period for filling out event sheets, checking point totals, planning activities, and discussing program changes.

12:30 - 1:00 - Sullivan Programmed Reading (all students).

1:00 - 1:30 - Distar Reading Penmanship Program. Students who had completed Distar A and B books continued working in Sullivan Programmed Reading.

1:30 - 2:00 - Suppes Math (all students).

2:00 - 2:15 - Recess.

2:15 - 2:45 - SRA Basic Reading Series (all students)

2:45 - 3:00 - Clean-up and dismissal.

Classroom Arrangement

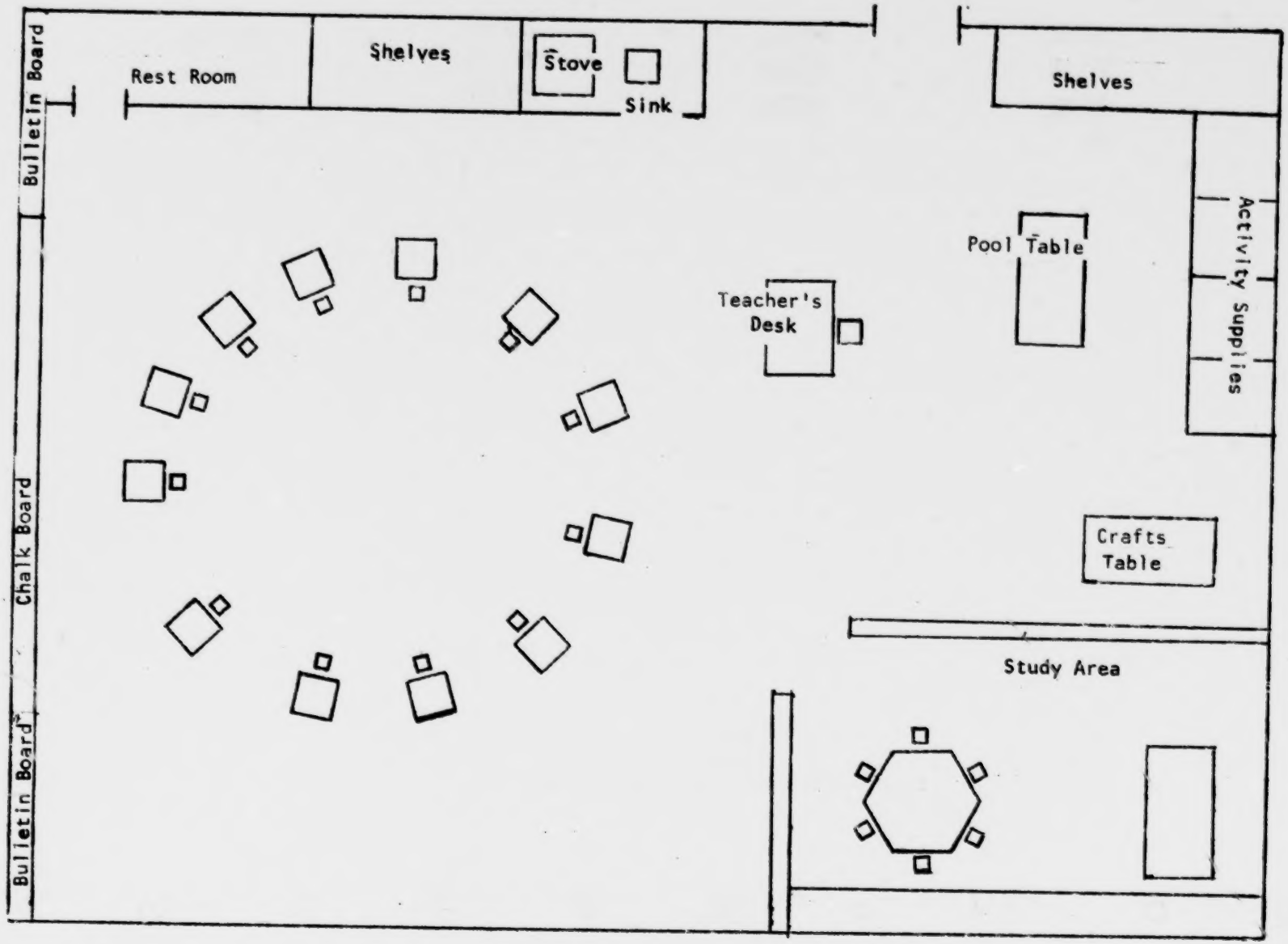
One section of each experimental classroom was set aside for activities the students had earned. That is, a student who earned, say, 5 points in math or reading could convert those points into 5 minutes of an activity of his choice--arts and crafts, games, etc.--in the "play" area. The other section of the classroom--the academic section--was divided into two parts to allow for large-group and small-group instruction. In the large-group area, the desks were placed in a circle with the students facing out. This arrangement facilitated teacher-student contact when the teacher corrected programmed materials and it tended to minimize student interaction. A round table was used for small-group instruction--Distar and SRA groups (Figure 6).

Presentation Procedures--Reading

Distar Reading

The class schedule was organized to place emphasis on reading and math. The initial basic reading program for students lacking letter recognition skills was Distar. All students lacking letter recognition skills, as determined by the probing procedure, began in Distar book A with the letter M. The classes were divided into two groups in order to facilitate the Distar presentation. Each group received thirty minutes of instruction during the Group Say-sound period. Each student gave say samples for letter recognition (Say-letters) and sound recognition (Say-sounds). Teachers recorded correct and error responses on a separate data sheet (Figure 7), and later transferred them to the event sheet. The amount of time for each sample varied; thus there is a "floating floor" for the Distar Group Say-sounds graph (Appendix). The students were allowed to move through the material in the Distar books (A, B, and C) according to their ability to meet the following criterion for any block of material: three consecutive days of errorless performance on group Say-sounds, on group Say-letters, and on individual Say-sounds. Following completion of Distar Book B, students were dropped from the afternoon Distar Penmanship Program and were moved into the Sullivan Write-letters program in Books Pre-1A, 1A, or 1 depending on their performance on the Sullivan Probes (See Probing Procedures).

Figure 6
Classroom Diagram



Correct	Error	Correct	Error	Correct	Error	Correct	Error	Correct	Error
32		34		32		31		30	
0		0		0		0		0	
40 sec		47 sec		41 sec.		48		42 sec	
(21)		(20)		(15)		07		20	

Dates 2-22-

Notes:

Figure 7
Example
Distar Group Say Sounds Recording Sheet

A token reinforcement system was utilized during the Distar Group Say-sounds period for the purposes of obtaining and maintaining student attention. The tokens were multi-colored plastic chips, each one redeemable at the end of the 30-minute period for a point. The number of points a student earned was entered on the event sheet, and during certain periods of the day the points could be "cashed in" for free time at the rate of 1 point for 1 minute.

Presentation procedures and the sequence of material closely followed the format of the Distar Reading Program with some minor changes made to facilitate continuous measurement (the use of stop watches, recording of responses) and utilization of the token system. The daily Distar session began when the students were seated quietly at the study table. Then, using the Distar Instruction Book (A, B, or C), a recording sheet (Figure 7), and stop watches (one for each child), the teacher provided the verbal stimulus indicated in the book and the children made either individual or group responses as indicated by the teacher. The teacher started the individual student's stop watch at the completion of every stimulus given to him and stopped the watch following the student's response. The teacher then recorded the student's response in the appropriate column (correct--error) on the recording sheet (Figure 7). At the end of every session each student's place in the book was marked with a color-coded chip, and his correct and error responses were totaled and entered on the event sheet along with the total response time indicated on his stop watch.

The Distar Group Say-sounds period was held in two groups in order to facilitate instruction. During the Distar Write-letter period, the class initially participated as one group, the students seated in a circle facing out (Figure 6). However, as students completed the alphabet they formed a new group (SRA Lab 1) at the back of the room. During the Distar Write-letter period all students began with the first letter of the Distar Sequence (M) and added one additional letter as soon as they mastered the ones they were working on. Mastery, as mentioned before, was defined as three consecutive errorless periods on three measurements: individual Say-sounds, individual Say-letters, and group Say-sounds. Following the addition of the first four letters (m, d, s, a) the teachers determined that most of the students could handle a larger addition of new letters. Subsequently, four new letters (as presented in the Distar Curriculum Guide) were added following the student's mastery of all previously presented letters.

The Write-letter work sheets were designed to show the stimulus for each letter on the left-hand column. Four pages were attached for student responses. Page one had one line of sample responses and one line of trace responses to be made by the student. Beginning on page two the students had three review pages of all previously presented letters (see Response Packet--Appendix). Following mastery of the first four letters the students received packets to work on for the next four new letters. At the beginning of the period, after students were seated quietly, the teacher provided them with Write-letter Packets. Each student

wrote the responses indicated by the teaching frame; after completing each line he raised his hand and the teacher corrected that line and recorded the correct and error responses in the corresponding time slot on the event sheet. The student erased all errors and repeated those responses until they were correct.

In conjunction with the Write-letter period, the teacher took one-minute samples of Say-sounds and Say-letters from each child using a stop watch and a double bank counter (Figure 8). The teacher presented a Stimulus Sheet containing only the letters the child was working on (see Appendix), and the student pointed to each letter and said the name, or sound, of that stimulus letter. The teacher then recorded correct and error responses on the student's event sheet. (See Appendix, Distar Say-sound and Say-letter Sample Plan Sheets).

Sullivan Reading

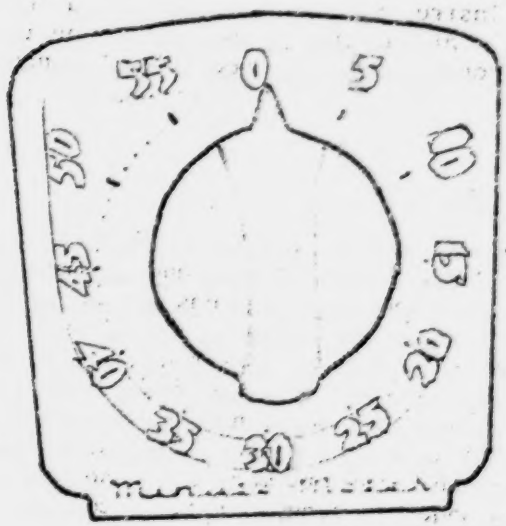
The Distar Reading Program was chosen as the primary tool for teaching the initial steps of reading because of its emphasis on the beginning sounds and the blending process. Sullivan Programmed Reading was chosen as a complement to the Distar Program because of its emphasis on sight words and student involvement in the program, and because of its easy adaptability to measuring techniques. A student's placement in the Sullivan Reading Program was determined by his performance in Distar (completion of Book A) and on the Sullivan Probes (see probes section). When working in a Sullivan book the student was required to stop at the end of each page and raise his hand so that the teacher could correct the completed page and record correct and error responses on the student's event sheet. The student then read aloud to the teacher those frames in which errors occurred. Corrections were made by the student and checked by the teacher. At the end of each period the last frame was dated and the book was put in the student's desk. (See Appendix, Sullivan Sample Plan Sheet).

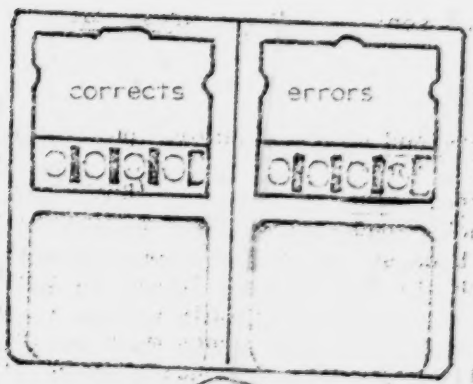
During the Sullivan Reading period one teacher worked with students on Write-letter exercises while the other teacher took one-minute oral reading samples.

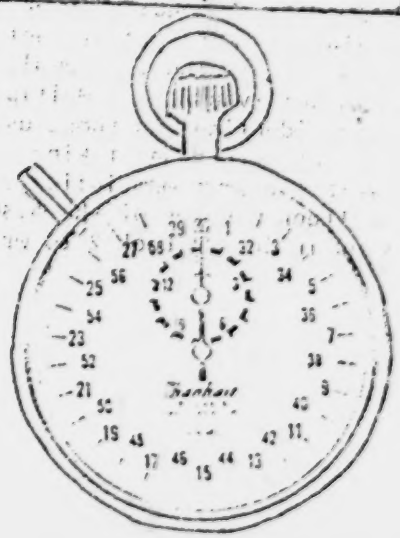
SRA Reading Lab

The SRA Reading Lab IA was used with those children who had completed Book C of the Distar Reading program. Students in the SRA program, as in Distar group Say-sounds, worked in two sections. During section 1 the students (4-6) assembled at the back table and each child first read a passage silently and then orally read one-minute samples of it to the teacher. The passages were from the lab booklets that students were working on during Section 2. Teachers took the one-minute oral reading samples daily for each child, and recorded the number of words read on a double bank counter. The correct and error scores were then transferred to the event sheet. Correct responses were defined as appropriate phonetic imitations of the stimulus words; error responses were inaccurate phonetic imitations and repeated words. During Section 2, the Write-letters period of SRA Reading Lab, the teachers gave each child the work booklet from the level he was then working in.

Figure 8
MECHANICAL AIDS FOR PRECISION TEACHING







The teacher instructed the student to "read to yourself the story that is on the front of this booklet. After you have read the story, raise your hand. Then I will start you on the questions." (See Appendix, SRA Sample Plan Sheet). For the questions, the teacher gave the child his Response Marking Sheet (see sample in Appendix) on which he responded to the questions on the back of the lab booklet. He was instructed to raise his hand when he completed the answers and the teacher would then correct his work with him. The teacher went over the error responses with the student and instructed him to "correct your errors, then raise your hand to call me." At the end of the period the total numbers of correct and error responses were recorded on the student's event sheet (Figure 9).

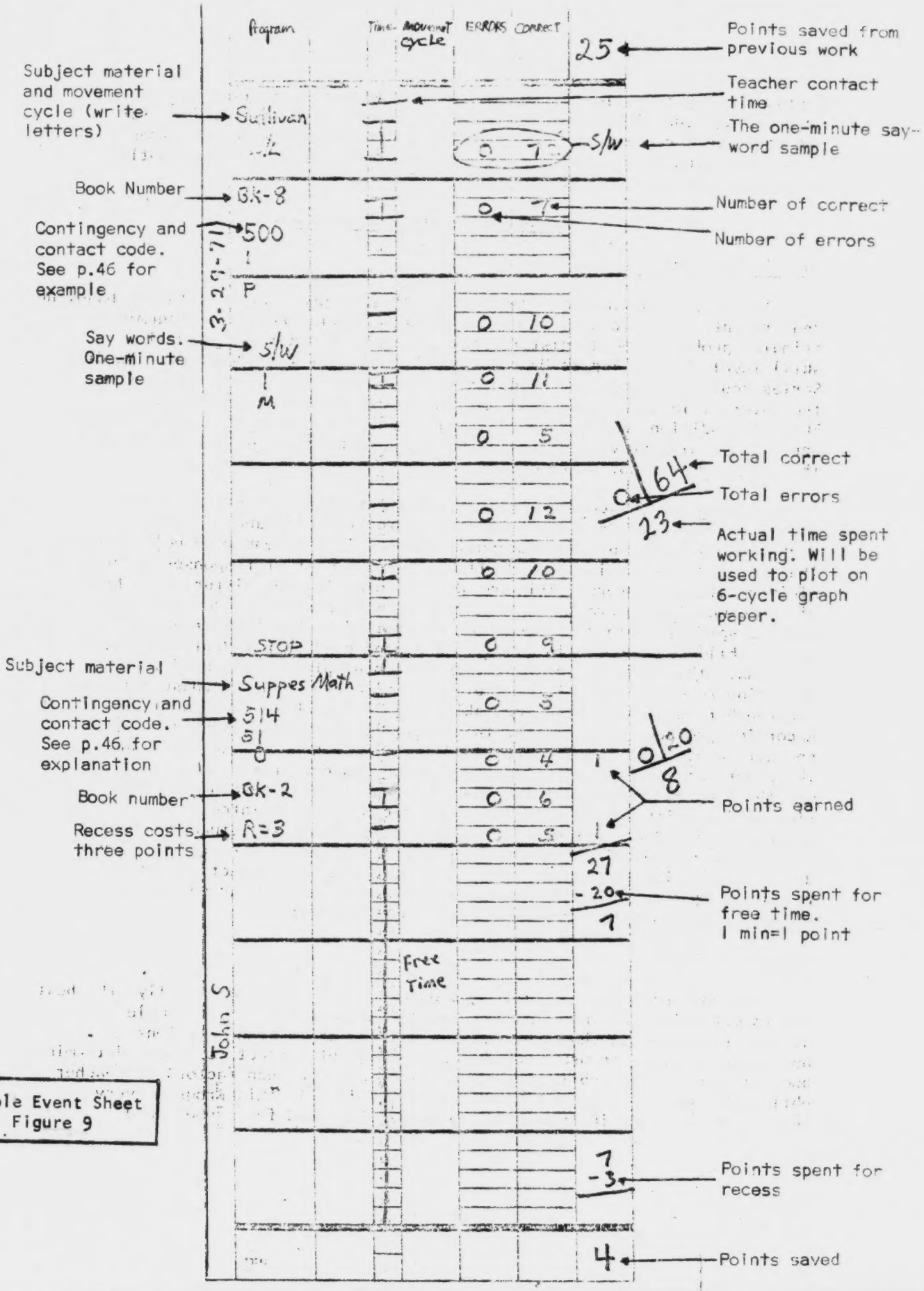
SRA Basic Reading Series

During the afternoon reading period (2:15-2:45) the SRA Basic Reading Series was used to develop silent reading and comprehension skills. The series begins with Book A and each book has an accompanying workbook. All students began in Book A and proceeded as far as they could go through the series, which ends with Book F. This reading period was divided into two fifteen-minute periods. For the first fifteen minutes all students read silently; one teacher took one-minute oral reading samples from each student while the other teacher gave assistance to the other students. During the second fifteen minutes the students made responses in their workbooks, raising their hands after two pages to request teacher correction. After the teacher corrected the pages he recorded the correct and error responses on the event sheet.

Presentation Procedures--Math

Suppes and Sullivan Math

Patrick Suppes' Sets and Numbers series, published by Singer/Random House, was the foundation for the math program. Supplementary materials were drawn from Sullivan's Programmed Math Series (Book 4-Multiplication, Book 5-Division), and from teacher-made Basic Facts Sheets-Multiplication. The Suppes math series was chosen because it provided comprehensive coverage of both traditional and new math skills, it lent itself to continuous measurement, and it was being used by the elementary schools of the Tacoma School District. The procedures for responding to the Suppes math material were the same as those used for the Sullivan programmed reading materials. Numerals, rather than letters written by the student, were used to determine a student's rate of correct and error responses. Following the completion of Suppes Books K, 1, and 2, students were placed in Sullivan Book 4-Multiplication. Presentation procedures for this series were identical to those used with Suppes. Beginning with Sullivan Book 4, teachers began taking one-minute oral samples from students on the basic-math facts in multiplication only (see sample in Appendix). In addition, fifteen minutes of the 8:30-9:30 period were set aside for students working in Suppes Book 2 to write the basic multiplication



Sample Event Sheet
Figure 9

facts. During this time the teacher presented multiplication sheets to a student and set a timer for fifteen minutes with instructions for the student to complete as many problems as he could before the timer rang. The student's correct and incorrect responses were subsequently graphed on the six-cycle graph paper.

Academic Materials--Placement

Baseline Measurement Conditions

The first experimental condition in this program involved taking baseline measurements and it consisted of two phases. During Phase I, academic stimulus probes were administered to each child so that his academic skill levels in the Suppes Math Program and the Sullivan Programmed Reading Series could be determined. The probes were made up of items drawn from the material in these programs. No teaching was allowed during the Phase I condition, and the child was given no reinforcement--teacher social approval or disapproval. Probes were not corrected during the day so that the students were not aware of their correct and error responses.

In Baseline Measurement Phase II, the students were placed in the Suppes and Sullivan Programs according to their performance on the probes. The individual teacher-pupil contact initiations were held constant. That is, the teacher intervened after a given number of responses in order to minimize student errors. This was done by stamping the picture of a hand with the word stop across it, and by using this picture to cue the child after a specific number of responses determined by the teacher prior to the child's placement in a book. The hand cued the student to raise his hand. The place in the book where the hand picture was used varied according to where new skills were to be introduced, and at these points the teacher had to teach the new skill before the child could continue. Recording procedures called for the teacher to correct responses on each contact, and to enter the correct and error responses on the event sheet. The program time on which correct and error response rates were calculated was the time during which the child had actually made responses. The time during which teachers initiated contacts was calculated as off-program time and was not considered when calculating the student's rate of responding. Baseline measurement Phase II continued for at least five days, after which time trend lines were analyzed; if correct and error responses had stabilized, the program was maintained. If trends were unacceptable, changes were made (see Trend Analysis).

Probes

The rationale for the probing procedure is that, theoretically, the best way to determine student placement in academic material is to sample student responses to that material. Decisions about such questions as how large a sample to use, and what percentage of correct responses determines book placement, are arbitrary, and they depend upon such factors as teacher philosophy and the time and materials available. In this program every tenth page from the instructional materials was used for probes, and

a student's book placement was at the point in the material where he began to show an error rate of 5%.

The probes were compiled from Suppes and Sullivan material and were administered at the beginning and end of the school year. One hour a day for three days of the first week of school was set aside for probes--a half hour for reading and a half hour for math. The students were instructed to respond to every question and told that no teacher aid would be given. A timer was set for thirty minutes, and when it rang the probes were collected and stored for later correction and evaluation.

Students' Book Placement

1. Distar Reading - All students were administered an alphabet recognition, writing and saying test to determine their placement in Book A or B of the Distar series. Book C focuses on blending and all students were required to progress through it before beginning the SRA Reading Lab.

2. Sullivan Reading - Book placement in the Sullivan program was determined by the point at which the student made 5% errors on the Sullivan reading probes. If 5% errors occurred in the middle of a book, a student was started at the beginning of that book in order to simplify administrative procedures.

3. SRA Reading Lab - All students began at the beginning of the Lab kit and proceeded through the material at their own rate.

4. SRA Reading Series - All students began in Book A and proceeded through additional books at their own pace.

5. Suppes Math - Book placement in Suppes was determined by the point at which the student began making 5% errors on the math probes.

Student Evaluation Procedures

Group Evaluation

The Wide Range Achievement Test was used for pre-post evaluation of the experimental and control classes, and was administered before intervention procedures in the fall and again in the spring after termination of the project. Two important indicators gained from the WRAT test are: the student's mean percentile of change in classroom ranking from the pre-test to the posttest, and the student's mean grade change from pre-test to posttest.

An evaluation of these mean changes provided information concerning the change in performance in terms of grade level and percentile rank. This information indicates that while the experimental classes were making significant grade change (more than one year's growth during the school year), the control classes made less than half a year's growth or grade

change during the school year (see Results section). That these changes were attributable to instructional procedures and not to innate student abilities can be determined by comparing the intelligence scores (on Stanford-Binet tests) for the control and experimental classrooms, taken from the placement tests administered by Tacoma Public School psychologists. The results from these test scores show the experimental classes had a mean I. Q. score of 72.3, while the control classes had a mean I. Q. score of 71.9, not a significant difference.

Individual Evaluation

Individual evaluation for students in the experimental group was a continuous process and required daily charting of data. On Friday afternoons the experimenters from the University of Washington analyzed the week's data and made recommendations for changes based on the trends of those data. For example, when a student made a high rate of responses but many of those responses were errors, the situation was often diagnosed as a program problem, and a change to less difficult materials, or to individual instruction on a particular concept, solved the problem. It was important to identify such situations quickly so that the student experienced success in his academic endeavors. Other data observations showed that when a child's error rate was stable or slowly rising, and his correct response rate was on the decrease, an intervention with reinforcements (either adding points to the program, or enriching the schedule) was sufficient to reverse the correct trend (see Continuous Measurement). Daily individual assessments were not made in the control classrooms.

Continuous Measurement

For effective student placement and continuous evaluation of whether the program is meeting its objectives, the teacher needs feedback to let him know how his students are progressing. In this project the major method for testing the effectiveness of students' placement and subsequent progress was to examine their correct and error rates on a weekly basis.

Because measurement of behavior provides essential information for placement and for decision making on what actions will be most effective in enhancing continued learning, it has been suggested that "measurement of behavior is the critical factor in teaching" (Haring & Phillips, 1971, in press).

Continuous measurement of academic performance is greatly enhanced if the academic materials used by students are programmed or semi-programmed, for these materials are presented in a way which requires active responding on the part of the student. Active responses may be divided into movement cycles (say sounds, write letters, write numerals, say words, etc.) which, when counted over time, are readily plotted on six-cycle graph paper as rate of performance. Other advantages of programmed instruction are that its step-by-step presentation of material facilitates the analysis of problems, it provides immediate feedback, and it allows for self-pacing by the student.

Taking continuous measurement involves several distinct and necessary steps. First, terminal behaviors must be established so that a child's progress toward those objectives can be determined. In this program, for example, a terminal objective in reading was that a student had to be able to say the name and sound of all the letters in Distar Books A and B before he began work in the SRA Reading Lab. The second step is to take baseline data (the initial measurement of a behavior) so that later manipulations of variables (materials, time spent working on materials, reinforcements, etc.) can be analyzed for their effectiveness. The third step is to determine what reinforcers will be effective. After taking baseline data and analyzing the child's responses, the teacher must evaluate how the child is performing and then determine what changes or manipulations (curricular changes and/or reinforcing contingencies) will best elicit accurate and efficient responding from the child. Finally, the teacher must evaluate the effectiveness of the manipulation which occurred following baseline. For this reason it is imperative that only one condition at a time be changed; otherwise, it is impossible to evaluate whether a given manipulated variable was the determining factor in any performance change. If this procedure is followed it is possible, after several sessions, to compare the student's baseline response rate data with the new response rate and then to evaluate the effect of the change introduced into the learning environment.

Continuous measurement based on response rate "enables the teacher to make comparisons of performance for the same individual at different times regardless of the response period as long as the responses are comparable" (Haring & Phillips, 1971, in press). The value of this is that instruction is truly individualized, for the child's progress is being compared only to his own past performance.

Continuous Measurement as a Diagnostic Tool

The primary function of any educational diagnostic tool is to aid the teacher in designing an educational program which will meet the needs of the individual student (Haring & Lovitt, 1967, p. 36). Several aspects of continuous measurement make this diagnostic tool particularly suited to achieving that goal. The first is direct assessment of observable behaviors, a procedure that permits the teacher to immediately and relevantly program instructional materials in a functional setting. The second diagnostic characteristic of continuous measurement is reliability. Since the measurements are made over an extended time period and involve many evaluations, the opportunity for behavior to stabilize is inherent in the procedure. The third diagnostically sound characteristic of continuous measurement is validity. Because continuous measurement is taken on day-to-day activities, it provides performance information concerning discrete tasks; this is the type of information a teacher requires in order to design individually relevant programs.

Rationale for Using Rate

Throughout this program, rate (of movements-per-minute) was the unit of measurement and it was always calculated for both correct and error responses. Rate was used because it best enables the teacher to interpret the three critical dimensions of a pupil's academic performance: "(a) Frequency - how many right and wrong answers; (b) Quality - what the correct to error ratio is; and (c) Time - how long it took to perform the task." (Lovitt, Schaaf, & Eaton, 1970, p. 18) Correct and error rates give the teacher all three of these pieces of information. For instance, rate tells the teacher the frequency of responses, and the time needed to do them. In addition, when both correct and error rates are taken the teacher is provided with either a ratio or percentage measure for comparing the two.

The two necessary elements when one uses rate as a basic measurement are movement cycles and time. Movement cycles are behaviors or performances which have three distinguishing characteristics. First, they are actions which have a definite beginning and end; second, they are actions which are repeatable; and third, they are actions which are under the students' control. A movement cycle is a specific action which can be counted. The task for educators who wish to measure rate is to separate academic performances into basic units which start and stop. Examples of some basic movement cycles are: say word, say letter, say number, write letter, write number, etc. However, counting movement cycles without recording the time in which they occurred would yield very little useful information. For example, if Ron writes 50 words correctly and Doug writes 200 words correctly it would superficially appear that Doug is four times better at word-writing than Ron. However, if Doug wrote his 200 words in twenty minutes and Ron wrote his 50 words in five minutes, then they were both writing at a rate of 10 words per minute. The fact that the movement cycle is under the student's control means that the teacher can, through manipulation of environmental contingencies which will depend on the student's behavior, help the student maintain, increase, or decrease the rate at which he performs the behavior being counted.

Evaluation Procedures: Trend Analysis

Analysis of trend line was used for evaluating all plotted data in this program. The procedure for establishing trend lines is as follows: For any given group of data plots, one must divide the data into two equal parts, and then find the median, and mid-middle point, of each half. These two points are then connected. One finds the median point by counting from the top or bottom to the center horizontal position of the data.

The mid-middle point is located by counting from each side to the center vertical position of the data (Figure 10). The interpretive information yielded by a trend line is basically descriptive--it tells

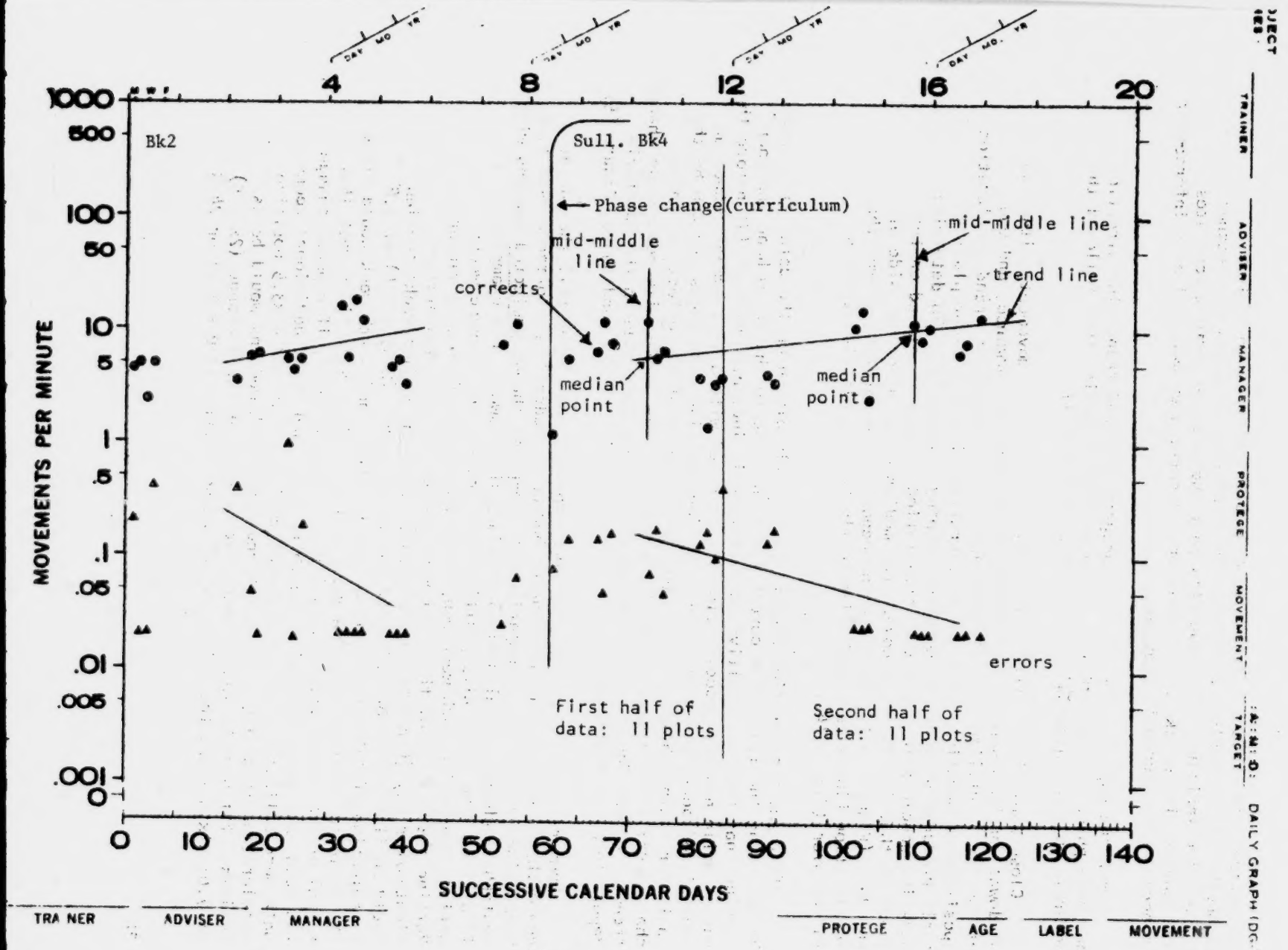


Figure 10

Phase Change and Trend Lines

you whether the student's performance is decreasing or increasing or whether it is holding constant. This information gives the teacher a sensitive indicator of a student's past and present performance rates, and enables him to make sound decisions on curriculum material or reinforcement changes in the student's program.

When the experimenters in this program analyzed trend line direction and made phase change decisions based on that analysis, they followed the general, rule-of-thumb guidelines shown in Figure 11.

Close analysis of trend line acceleration (i.e., movement, either up or down) can be a sensitive indicator of student performance, and one of the tools utilized by the experimenters to determine trend acceleration (positive or negative) was the Acceleration Finder, a clear plastic strip produced by Behavior Research Company (Figure 12). To determine positive acceleration (up) the Acceleration Finder is placed on the graph so that its X1 point covers the median-midpoint of one side of the data (Figure 13). To determine negative acceleration (down) the Acceleration Finder is placed identically but the plastic strip is turned over (Figure 14).

After the Acceleration Finder is correctly placed on the data, it is read by following the line which covers the trend line to the arrow head and then reading that figure. Positive acceleration is indicated with an (X) before the number while negative acceleration is indicated with a (÷) symbol. Such an analysis of performance calls for a minimum of five data plots and can be the basis for making phase changes. But the analysis of the effects of phase changes calls for a comparison of pre-phase change trends with post-phase change trends. On the Tacoma Project these comparisons were made on the Quarterly Report forms and included a description of Median, Trend, and Range (Figure 15).

Comparisons of pre- and post-phase change trend lines tell the educator how much effect a given phase change had on a student's performance over time. When using trend lines a comparison of pre-phase change projected medians with post-phase change actual medians provides the answer. For example, if a trend line had a X1.5 positive acceleration for a three-week period, the median each week would increase in the following manner. Putting the median of the first week's data at 1.7 movements/per minutes/per day (for a beginning point), then the second week's median would be (1.7 x 1.5) or 2.55, and the third week's (2.55 x 1.5) or 3.8. A projection of this trend into a fourth, fifth, and sixth week would yield the following medians: fourth week (3.8 x 1.5) or 5.7, fifth week (5.7 x 1.5) or 8.5, sixth week (8.5 x 1.5) or 12.7. However, if a phase change had been instituted following the third week, and three additional weeks' data were collected with a first week median of 2.0 and a x3.5 positive acceleration trend line, the fifth and sixth week medians would be as follows: fifth week, that is, the second week of phase change (2x 3.5) or 7.0; sixth week, the third week of phase change, (7.0 x 3.5) or 24.5

Figure 11

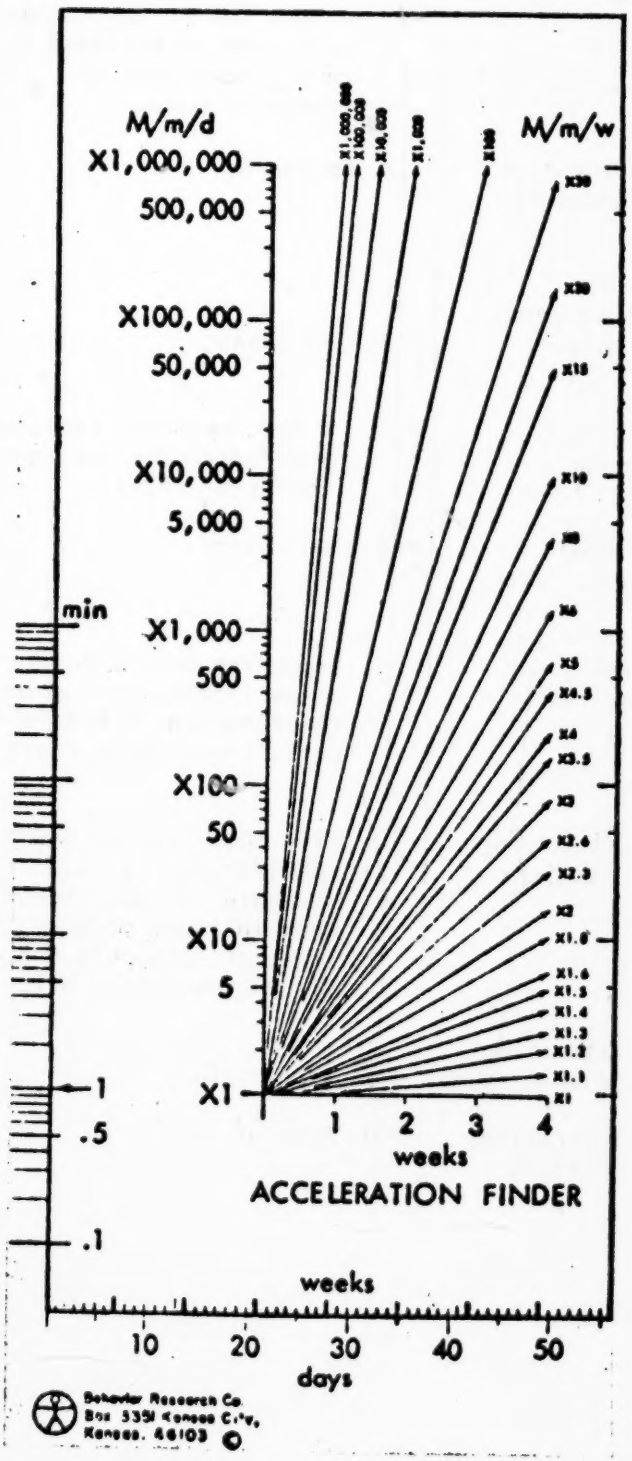
Rule-of-thumb guidelines for implementing phase changes

Trend Direction	*	Possible Program Change
1. Correct rate acceleration with error rate accelerating.	⟋ ⟋	1. No change would be initiated for one week unless one of two things occurred: 1) correct rate decelerated or 2) error rate maintained acceleration. See # 4 for type of change to make.
2. Correct rate acceleration with error rate decelerating.	⟋ ⟍	2. No change.
3. Correct rate acceleration with error rate holding constant.	⟋ —	3. No change.
4. Correct rate holding constant, with error rate accelerating.	— ⟋	4. A cost response contingency (points are subtracted for too many errors) constructed for error rates.
5. Correct rate holding constant, with error rate decelerating.	— ⟍	5. No change.
6. Correct rate holding constant, with error rate holding constant.	— —	6. Depending on the desired rates of both dimensions (correct and error), the correct rate reinforcement schedule might be enriched, while error rates might be ignored.
7. Correct rate decelerating with error rate accelerating.	⟍ ⟋	7. Five possible treatment alternatives can be considered: 1) lower teacher contact schedule, 2) additional practice, 3) placement in lower program, 4) enriched reinforcement schedule for correct responding, 5) combination of all.
8. Correct rate decelerating with error rate decelerating.	⟍ ⟍	8. Same as 6.
9. Correct rate decelerating, with error rate holding constant.	⟍ —	9. Same as 6.

*Chart line direction

Figure 12

Trend Line Acceleration Finder



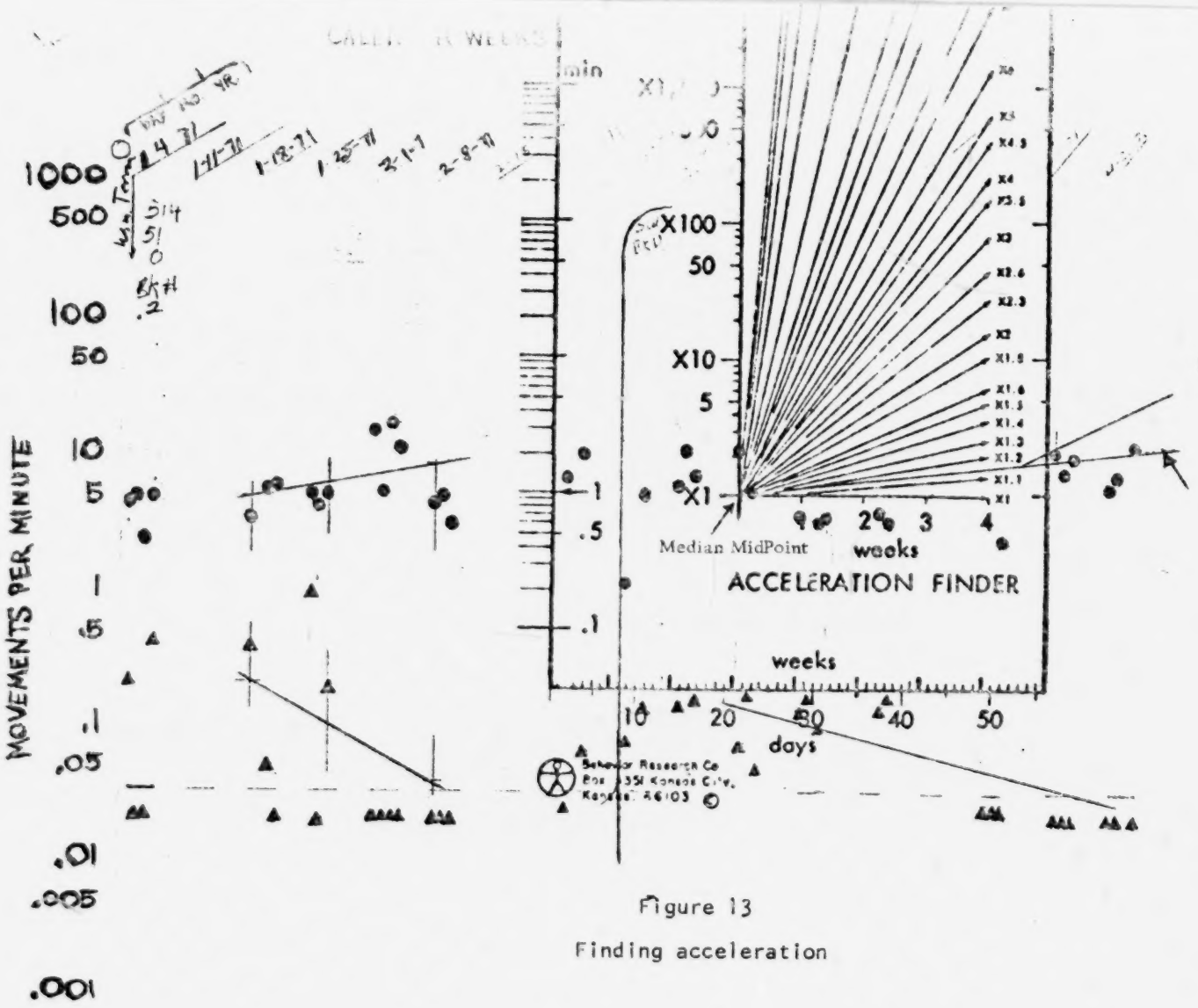


Figure 13

Finding acceleration

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140

SUCCESSIVE CALENDAR DAYS

Maddux
SUPERVISOR

O'Leary
ADVISER

MANAGER

DEPOSITOR

AGENCY

Doug. B
Sittall

AGE

Write #'s
MOVEMENT
Suppes 21.

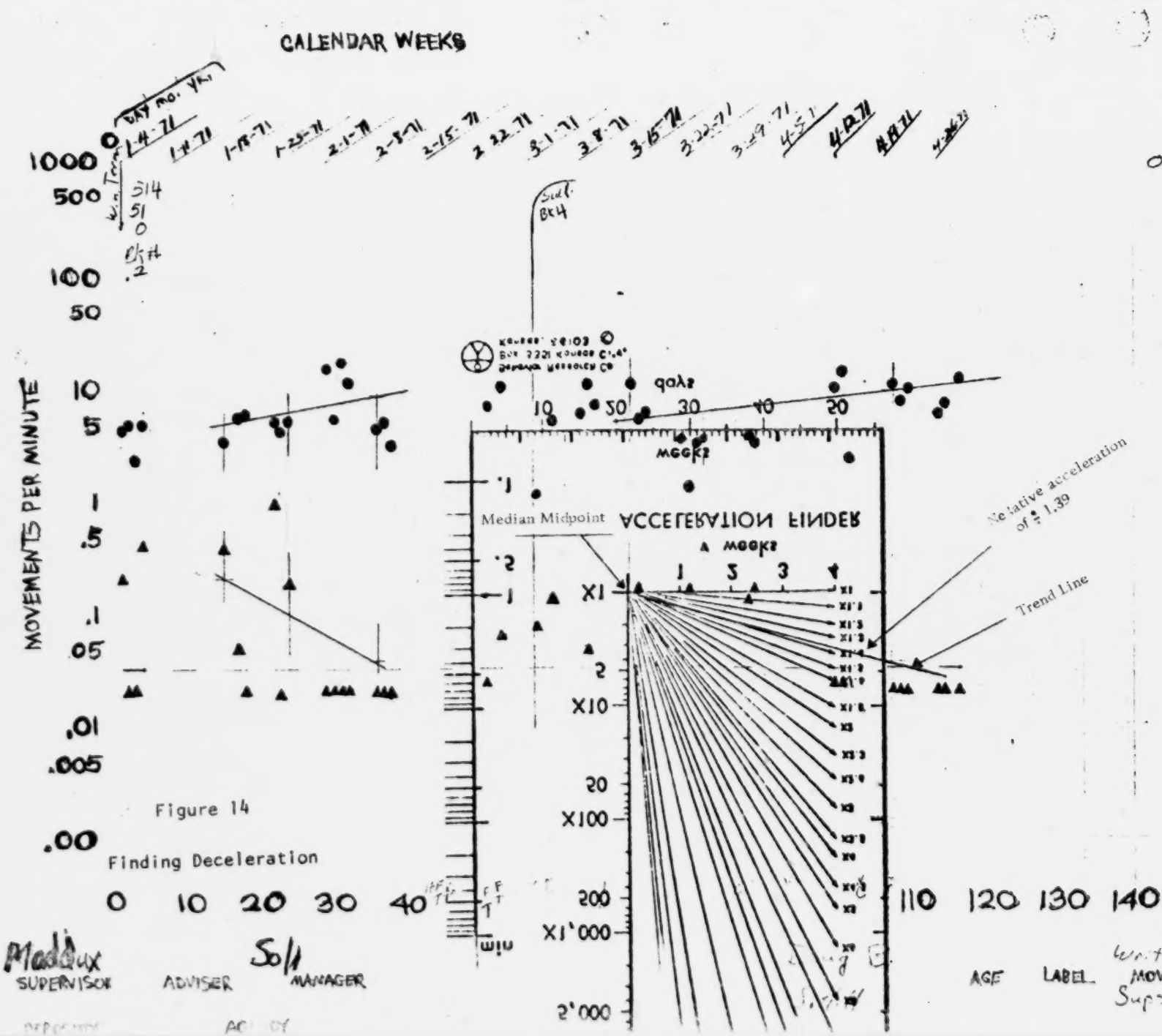


Figure 14

Finding Deceleration

09-6

SUPERVISOR ADVISER MANAGER

AGE LABEL MOVEMENT

Figure 15

Summary Chart of Phase Change Effects

Sample

Rules: 1. Same signs (x or ÷) are divided.
2. Different signs (x, ÷ or ÷, x) are multiplied

Rate Description			Effect Description		
Median	Trend Per Week	Range Per Cond.			
I. Baseline					
C 4.5	C ×÷ 1.1	C 6 to 4.3			
E 1.9	E ×÷ 2.0	E 16 to 13			
II. Effects of Range Number One.					
Median	Trend Per Week	Range Per Cond.	Median	Trend	Range Change
C 5.0	C ×÷ 1.2	C 7.3 to 1.8	C ×÷ 1.1 m/m/wk	C ×÷ 1.3 m/m/wk	
E .05	E ×÷ 1.8	E 0 to 1	E ×÷ 3.8 m/m/wk	E ×÷ 3.6 m/m/wk	
III. Effects of Range Number Two.					
Median	Trend Per Week	Range Per Cond.	Median	Trend	Range Change
C 5.5	C ×÷ 1.15	C 1 to 14	C ×÷ 1.1 m/m/wk	C ×÷ 1 m/m/wk	
E .08	E ×÷ 1.39	E 0 to .3	E ×÷ 1.6 m/m/wk	E ×÷ 1.3 m/m/wk	

Range Change Not Calculated

m/m/wk=mean movements per week

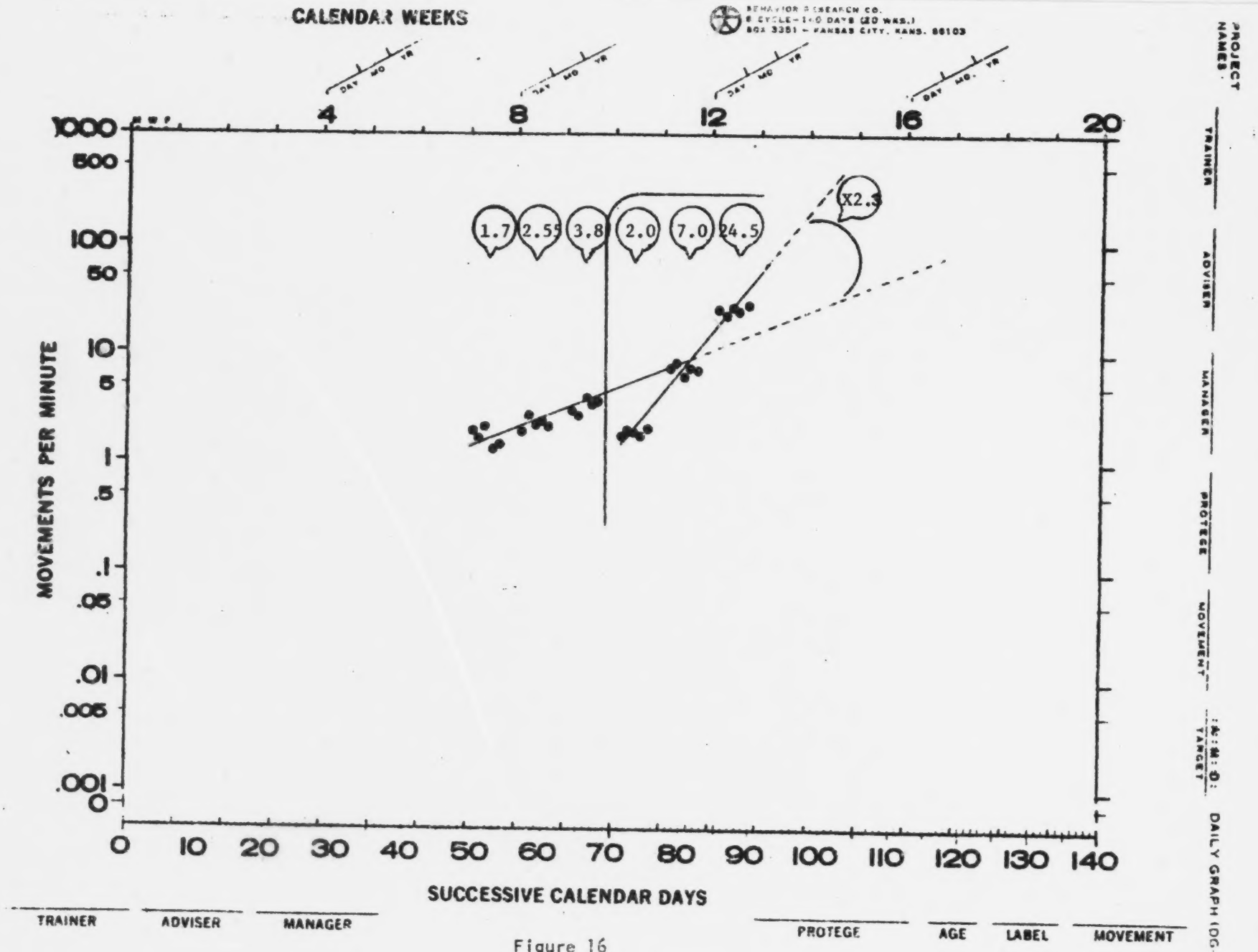


Figure 16

Effect of phase change based on projected trend line analysis.

(Figure 16). The relationship between the projected trend line and the actual trend line can be analyzed by dividing the smaller trend acceleration number (x1.5) into the larger (x3.5), i.e., x3.5/x1.5 or x2.33. This is the deviation of the post-phase change trend line from the projected pre-phase change trend line.

Phase change effects were summarized quarterly on the Tacoma Project and recorded on the Classroom Quarterly Report forms developed at the Experimental Education Unit (Figure 15).

Contingency Management

After baseline data have been collected, trend lines have been analyzed, and the decision to change materials or establish consequences for responses has been reached, the teacher who is using a token reinforcement system is then faced with the problem of determining payoff schedules and establishing item costs. A haphazard establishment of payoff ratios and costs can lead to situations in which some students are never earning enough points to buy items, while other students are able to deplete the "store" within a day or two. To prevent such occurrences, and to provide a situation which the students consider equitable, the experimenters used the following formulas for establishing point-earning ratios and for determining prices for reinforcement items:

1. Establishing Point-Earning Ratios
   a = The Subject's mean rate (movements-per-minute)
   b = Total session time
   c = The expected number of responses per session, or (a) times (b)
   d = The number of minutes available as a consequence
   e = Ratio, or (c) divided by (d)
   Example: A pupil's mean rate of responding in a session of ten minutes is fifty. The number of minutes available as a consequence is 20.

   Solution
   a = X rate = 50
   b = Session time = 10
   c = 50 x 10 = 500 responses
   d = Time available = 20
   e = Divide 500 by 20 = 25:1

If the Subject earns one point for every 25 responses, and 1 point equals 1 minute of free time, the Subject has earned enough to pay for the free time.

2. Determining cost value, or number of points required to "purchase" an item

a = The Subject's mean rate (movements-per-minute)
b = The average session time
c = The expected number of responses per session, or (a) times (b)
d = The minimum number of sessions you want the Subject to work before he is able to "purchase" the desired consequence
e = The number of responses expected, or (c) times (d)
f = The ratio desired (e.g., 5:1, 10:1, see #1) to obtain item.
g = Desired "cost" of the item, or (e) divided by (f).

Example: The Subject's mean rate is 50, the session time is 10 minutes, the number of sessions before payoff is 10, and the desired ratio has been determined through using formula 1 to be 10:1

Solution:

a = Mean rate = 50
b = Session time = 10
c = 50 times 10 = 500
d = Number of sessions = 10
e = Number of responses (c times d) = 5,000
f = Desired ratio = 10:1
g = 5,000 divided by 10: The purchase price of the item should be 500 points.

Reinforcement contingencies used in this program were usually free time and items or games which were known to be extremely interesting to the students, such as car models. When a student purchased free time, a timer (set for the number of minutes purchased) was placed on his desk. The student then went to the activities area where he could engage in whatever activity he chose, such as building models, playing pool, doing puzzles, painting, listening to records (with a head set), and playing with a car set. When the timer rang, the student immediately returned to his seat for further academic work. Students were allowed to spend points for time only during those academic periods in which they were earning points. The cost for time always remained at the fixed ratio of 1 point for 1 minute, and a student always determined how many points of his total he would spend to buy time during a point-earning period.

When trend line analysis of a student's performance data indicates the need for a program change, the teacher has several courses of action available. He may manipulate teaching procedures (contact frequency, etc.) or the programed material, or he may manipulate the arranged event (those happenings which are contingent on a pupil's behavior). An arranged event, for example, occurs when a pupil receives X number of points for correctly solving X number of problems. An illustration of the contingency management procedures used in this project is found in the following case

study of one of the students. This study has been reported in the April, 1971, issue of Educational Technology (Haring, 1971).

> ...Juanita was put on a fixed ratio schedule of token reinforcement contingent upon the number of responses written which were correct the first time. For every five correct written numbers Juanita received one point. One point equalled one minute of free time. Recess for fifteen minutes beginning at 10:30 a.m. cost twenty points. Candy, jacks, and other small items could also be purchased by any member of the class at a predetermined point value. The teachers determined the ratio schedule. [Juanita] determined how and for what her points would be used. The alternative program if the child did not have points to attend recess was Suppes Math....
>
> During the [next] fourteen days [Juanita] was subject to a 5:1 fixed ratio schedule contingent upon correct write number responses...[her] median correct response was 1.5 responses per minute. During the second phase of baseline measurement when she was working in a book, the median correct rate had been 4 correct responses per minute. Although correct response rates during the first fourteen days of the experimental condition of fixed ratio token reinforcement showed slight positive acceleration, the teachers determined that a second experimental condition should be instituted as an attempt to raise the median level of correct responding....[Therefore, following the fourteen days of baseline data] one condition was changed. The points necessary to buy recess were reduced to 10. This did, in fact, raise the median level of correct responding to 2.4 correct responses per minute. It also dramatically changed the slope of the best fitting straight line projected through [the next] seventeen days of data.

Contingency Coding: Contact Codes

In order to keep track of the point-earning ratios and the teacher contact schedules for each student, a contingency coding system was used. The code was placed directly under the academic subject title on the event sheet, enabling the teacher to quickly determine at each contact if the student was on a point-earning contingency, and how many points he had earned. The number of points earned was calculated and entered on the event sheet to the right of the Correct column (Figure 9).

The codes used on the project were based on the Contingency Coding System developed at the University of Washington Experimental Education Unit and were interpreted in the following manner:

#1. 500
1
0

The 5 specifies a pupil-initiated contact. The number under 5--in this case, 10--is written vertically, and means that the student must make 10 responses before raising his hand.

#2. 500
1
P

The 5 is interpreted the same as in example #1. The 1P indicates that the student must complete 1 page before raising his hand.

#3. 514
16
0

In this example the 5 and 10 mean the same as in example 1. The 1 following the 5 means that the teacher is giving points to the child for correct responses. The 6 under the 1 tells the teacher to give the child 1 point for every 6 correct responses, a 6:1 schedule. The 4 in this example indicates to the teacher that the pupil will specify how and when during a point-earning session he will cash in his earned points.

Results and Discussion

Test Selection and Administration: Wide Range Achievement Test

The WRAT was selected as the means for making a comparison of students' academic performance in the experimental and control classes. Determining factors in the selection were the following: a) test administration time is short; b) no special skills are required for administration; c) both reading and math are tested; and d) the test has been standardized.

The WRAT was administered to all classes (experimental and control) by the experimenters during the week of October 15, 1970, and during the week of May 20, 1971, following project termination. The test was administered and scored as directed by the WRAT Instruction Manual.

Results were compared on a classroom basis and yielded a pre-post mean for each subject area. The differences between these means were determined and gave the mean growth (or lack of growth) in each subject area for each classroom (Appendix E).

Results and Interpretation

Each classroom's pre-post grade standing for each academic area tested was determined by finding the class mean score ($\bar{x}1$ = pre-score, $\bar{x}2$ = post-score) on the WRAT. The tests were administered eight months apart. The difference between these means ($\bar{x}2 - \bar{x}1$) gives the number of months' grade change (up or down) that the class made. According to this method, if a class advanced eight months (.80) then the class had been advancing academically one month for each month's work. The chart (Appendix E) shows that the students in the McCarver classroom (as a group) advanced 1.40 (ten months ÷ 4 months = 14 months), or 6 months (14-8=6) more than was expected, in the subject of reading. By the same method of calculation, the Edison I classroom regressed (as a group) by one month (8-9= -1) over the same eight month period in the subject of reading (Appendix E).

This chart also shows that in the subject of spelling there is no significant difference between the experimental and control classes. In light of the fact that spelling was not formally taught in the experimental classes, it becomes even more clear how effective the experimental procedures were. It also indicates that very little transfer carried over from reading, suggesting that if progress is desired in a specific subject, then that particular subject will have to be taught in a structured and emphasized manner.

A standard t test (Edwards, 1967) was used to evaluate the pre-test,post-test differences between the control classes and the experimental classes for both reading and math on the WRAT. The t test analysis was performed on both the grade placement change, and the percentile change. Grade placement change for the experimental classes for both reading and math was significant at the .005 level. The percentile change for both reading and math was significant at the .05 level (Figure 17).

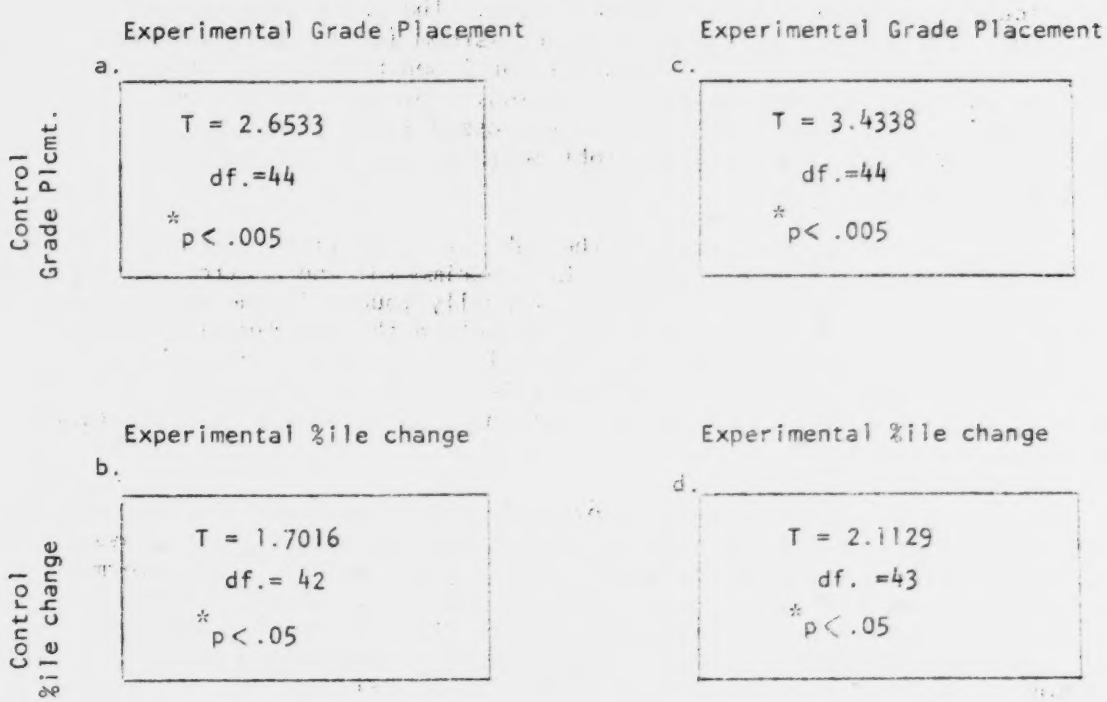
Discussion

An evaluation of individual rate changes paired with the variables of curriculum, time of day, and contingency management provides a sensitive indicator of the effectiveness of instruction. Teachers need this information for developing effective individual programs. Administrators, however, need more gross group measurements in order to make their decisions. For the administrator's purpose then, classroom comparisons with such tools as the WRAT can provide the information necessary for determining what type of instructional materials and methods are achieving the most effective overall results.

A comparison of the experimental classes with the control classes on the Tacoma Project by the method of mean growth shows that in grade gain for reading, the experimental classes averaged 11 months gained

Figure 17

WRAT Reading, WRAT Math



a. Comparison of experimental and control class grade level gains in reading.

b. Comparison of experimental and control class percentile gains in reading.

c. Comparison of experimental and control class grade level gains in math.

d. Comparison of experimental and control class percentile gains in math.

while the control classes averaged a 2-month decrease. In math the experimental classes achieved a mean gain of 14 months. The control classes made a mean gain of 2 months. From this information it is easy to see that the experimental classes made significantly more progress in reading and math than did the control classrooms.

Evaluation of Suppes Math and Sullivan Reading Performance

Introduction

Selection of Sullivan and Suppes was based on evidence (Haring et al., 1970) that the performance of children on these programs showed a relatively small error rate. Even so, these two programs are at best only a crude approximation of the objective to achieve an errorless program. An analysis of each child's performance by am. and pm. was carried out to examine the rate of error by book for each program.

Computer analysis of the Project's data was made for the Suppes Math Program and for the Sullivan Reading Program. For comparative purposes morning work (a.m.) was analyzed separately from afternoon work (p.m.), and baseline data (Suppes) were analyzed separately from intervention data. Each student's correct and error rates were evaluated by finding the mean, standard deviation, median, the minimum response mode, and the maximum response mode (range). These measures were then taken on the experimental classes as a group.

Using the mean in conjunction with the standard deviation provides a fairly accurate interpretation of where the data plots are occurring especially if the standard deviation is a relatively low figure. When the standard deviation is high, however, the probability is that the mean is being pulled up or down by a low number of atypical plots. In such instances the median is probably a more accurate indication of where data plots are occurring.

Analysis of Charts in the Appendix

1. Chart A(pages 1-8): Suppes Book 1, a.m., p.m., and Suppes Book 2, a.m., p.m.

Results: These charts provide a comparison of a student's correct and error responding rate between morning and afternoon performance for Suppes Books 1 and 2.

For Book 1, the correct rate mean-median measurement was higher in the morning for eight of the students, no different for one, and higher in the afternoon for four of the students (eight students had no afternoon math, so no comparison can be made for them). However, the overall

class mean-median was higher for the afternoon. The reason for this is that the eight students who did better in the morning tended to respond at only a slightly lower rate in the afternoon. The students with the higher afternoon responding rate, however, tended to respond at a much higher rate in the afternoon than in the morning.

A morning-afternoon comparison for Book 2 shows seven students responding at a higher morning rate, and five students responding at a higher afternoon rate. Again, the class mean-median correct responding rate is slightly higher for the afternoon. The error responding rates for both Suppes Books 1 and 2 were slightly lower for the class average during the afternoon session.

A comparison between Books 1 and 2 responding rates (morning and afternoon) shows that a) 52.3% of the students increased their correct rates, while decreasing their error rates, b) 9.5% of the students showed an increase in correct and error rates, c) 33.3% of the students had a decrease in both corrects and errors, and d) 4.7% of the students had a decrease in correct rate and an increase in error rate (Figure 18). The class mean correct responding rate for Books 1 and 2 changed from 3.6 to 4.6, while the mean error rate changed from 0.11 to 0.06 (see Appendix D charts).

Interpretation. An analysis of individual student mean correct and error response rates, comparing morning and afternoon performance on Book 1, shows that there were no significant differences between the morning session and the afternoon session. A comparison of students' morning and afternoon correct and error rates on Book 2 shows that the error rate for Book 2 was significantly lower ($p < .05$) for the afternoon session, with no significant difference in correct responding rates (Figure 19). These comparisons lead to the conclusion that the students performed as well, i.e., made as many responses, in the afternoon as in the morning. In addition, a comparison of Suppes Book 1 morning and afternoon correct and error response rates to Suppes Book 2 morning and afternoon correct and error response rates shows that student correct response rate for Book 2 did not differ significantly from that for Book 1. The afternoon error rate for Book 2 was, however, significantly lower ($p < .05$) (Figure 20). This indicates that although the material was more complex, students were maintaining their correct responses while decreasing their error responses.

Discussion. The optimum learning situation is condition (a) in which correct response rate is increasing, error responses are decreasing and the material is becoming more complex and difficult. Condition (c), in which error response rate is decreasing while there is a stable or slowly decreasing correct response rate, is acceptable when material level is increasing in complexity.

The effectiveness of the precision teaching techniques used in the Tacoma Project math program is demonstrated by the fact that 85.3% (18) of twenty-one students met the requirements of conditions (a) or (c). In condition (b)

Figure 18

Suppes Bk1-BK2
Trend Directions

	Correct Increase	Correct Decrease
Error ecrease	52.3%	33.3%
Error ncrease	9.5%	4.7%

Student performance trend directions in Suppes Math

Figure 19
Morning-Afternoon Comparison of
Suppes Correct and Error Response Rates

SUPPES BK-1

	Corrects A.M.	Errors A. M.	
Corrects PM	T = .50237 df = 25 Not significant at .05 level	T = .91459 df = 25 Not significant at .05 level	Errors PM

SUPPES BK 2

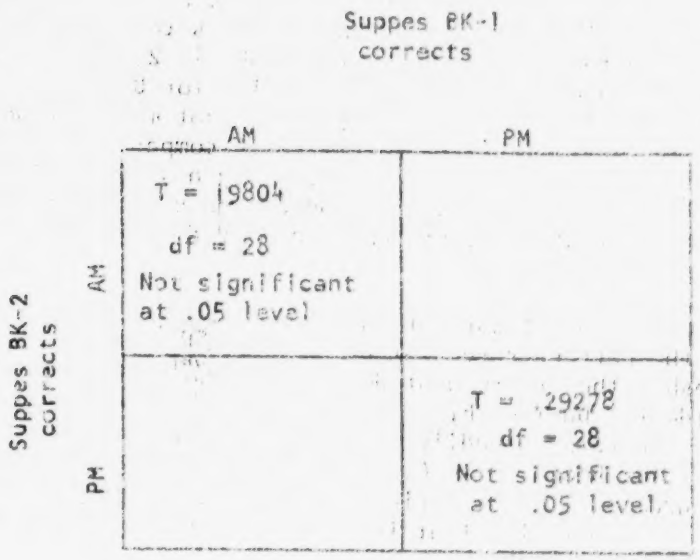
	Corrects A.M.	Errors A.M.	
Corrects PM	T = .468628 df = 31 Not significant at the .05 level	T = 1.72533 df = 31 *p .05	Errors PM

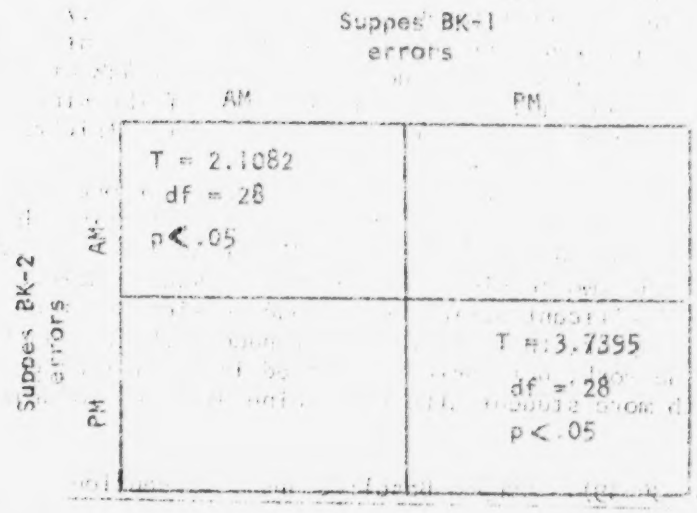
*Afternoon Suppes Math Book 2 showed a significant lowering of error rate.

Table 1

Figure 20

Comparison between Suppes BK-1 to BK-2 morning-afternoon
Correct and Error Responses





Error response rates for Book 2 (both AM and PM) decreased to a significant degree.

Table 2.

students show an increase in correct and error rates; in condition (d) they show a decrease in correct rate and an increase in error rate. The three students whose work fell into these conditions--9.5% (2) in (b) and 4.7% (1) in (d)-- had borderline situations which were not significantly different from condition (c).

2. Chart B (Pp. 9-29) Sullivan Books 1-10, First and Second Sessions.

Results: A comparison of first session means to second session means for the class averages on Sullivan Books 1 through 6 shows that the mean correct responses were higher in the first session for Books 1, 2, and 6, and that the error responses were higher in the first session for Books 2, 3, 4, and 5. There were no differences for Book 6. Analysis was not made beyond Book 6 because not enough students advanced beyond it to warrant a comparison. This comparison of first session to second session shows that providing a second half-hour of work immediately following a half-hour session produced no consistent changes in rate. The conclusion, then, is that these students can and do work for long periods of time at a high level of performance.

A between-book comparison of correct and error response means for the first session shows that the correct rate went up on the even numbered books and in an inverse relationship the errors went down. For the second session no such relationship is evident. During this session (the second session) the correct responses tended to increase steadily as the error response rate increased slightly and then held steady for Books 5 and 6. From these results it seems that the books in the Sullivan Programmed Reading series increase in difficulty in an uneven way. For example, a teacher might find that increases in correct rates are consistently higher in the even numbered books.

A between-book comparison for individual students shows that as the students moved into more complex material (higher book numbers) a) 21.7% of the students increased their correct rates while decreasing their error rates, b) 24% of the students made an increase in correct and error rates, c) 44% of the students had a decrease in both corrects and errors, and d) 10.3% of the students had a decrease in correct rate accompanied by an increase in error rate (Figure 21).

Discussion: The Sullivan Write-letters period was for one hour in the afternoon, divided into two half-hour sessions for purposes of evaluating the effects of time on response rate maintenance. No clear differences in correct responding rates exist between the two sessions for the two classes. However, the decrease in error rates was significant during the second session for four of the six workbook compared. It would appear, then, that the extended work period did not create fatigu or disinterest in the work, but instead resulted in a maintenance of correct responding rate with more student attention being directed towards elimination of error responses.

3. Chart C (Pp. 30-39) - Suppes Baseline and Intervention

A standard t test (Edwards, 1967) was used to evaluate the relationship between Baseline correct - error rates, and Intervention correct-error rates. The effect of Intervention on correct rates was not significant at the .05 level. However, the effect of Intervention on error rates was significant at the .005 level (Figure 2 The significant change in error rate can probably be attributed to the fact that most phase changes (Intervention) were instituted for the purpose of reducing error responses.

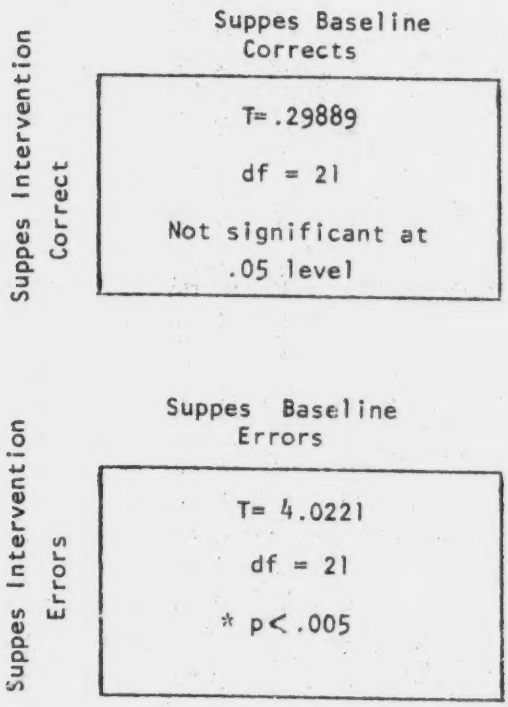
Figure 21
Sullivan--All Books
Trend Directions

	Correct Increase	Correct Decrease
Error Decrease	21.7%	44%
Error Increase	24%	10.3%

Sullivan First half-hour performance to Second half-hour performance trends.

Figure 22

Baseline-Intervention



Individual Academic Histories of Experimental Classes

Academic Case Summaries on Sullivan, Suppes and SRA Material

1. June T. began Sullivan Book I on 9/28/70 with a correct Write-letter responding rate of 5.0 letters per minute. Her error rate was .1 letters per minute. At termination she was working in Book 6 with a correct rate of 5.5 letters per minute and an error rate of .02 letters per minute. June started in Suppes Math Book 1 on 9/21/71 at an initial rate of 3.2 numbers correct per minute, and .04 errors per minute. At termination she was working on the latter part of Book 2 and was responding at a 9.1 per minute correct rate with a .00 error rate. At the end of the school year June was working on basic multiplication and division facts. The SRA reading program was started on 1/11/71 with June in Book A; her initial correct reading rate was 40 words per minute, and her error rate was 5 words per minute. At termination she was reading 51 correct words per minute, with 0 errors in Book C. June's correct rate trends continued to rise with an increase in material difficulty, while her error rates decreased.

2. Robert D. began Sullivan Book IA on 1/18/71 with a correct rate of 5.1 letters per minute and an error rate of .06 letters per minute. Robert started in Suppes Math Book 1 on 9/28/70 at initial rates of 4.2 numbers correct per minute and .2 errors per minute. At termination he was on the latter part of Book 2, he was responding at a 5.5 per minute correct rate and a .03 per minute error rate. At the end of the scool year Robert was working on basic multiplication and division facts. The SRA reading program was started on 1/11/71 with Robert in Book A at an initial correct reading rate of 63 words per minute. His error rate was 3 per minute. At termination he was reading 96 correct words per minute, with 0 errors in Book C. Robert's correct rate trends continued to rise with an increase in material difficulty, while his error rates decreased.

3. Doug B. began Sullivan Book I on 10/19/71 with a correct responding rate of 4.5 letters per minute. His error rate was .35 letters per minute. At termination he was working in Book 7 with a correct rate of 8.3 letters per minute and an error rate of .2 letters per minute. Doug started in Suppes Math Book 1 on 9/21/71 with initial rates of 4.6 numbers correct per minute and .3 errors per minute. At termination Doug was working on Sullivan Math Book 4 (Multiplication) at a correct responding rate of 5.3 and an error rate of .00. At the end of the school year Doug was working on basic multiplication and division facts. The SRA reading program was started on 1/11/71 with Doug in Book A and his initial correct reading rate was 56 per minute. His error rate was 6 per minute. At termination he was reading 63 correct words per minute, with 0 errors in Book D. Doug's correct rate trends continued to rise with an increase in material difficulty, while his error rates decreased.

4. Clara M. began Sullivan Book 1A on 10/5/71 with a correct responding rate of 3.0 letters per minute. Her error rate was .14 letters per minute. At termination she was working in Book 9 with a correct rate of 8.6 letters per minute and an error rate of .15 letters per minute. Clara started in Suppes Math Book 1 on 9/28/71 with an initial rate of 4.1 numbers correct per minute, and an error rate of .1 per minute. At termination she was on the latter part of Book 2 responding at a 6.0 per minute correct rate and a .04 error rate. At the end of the school year Clara was working on basic multiplication and division facts. Clara's correct rate trends continued to rise with an increase in material difficulty, while her error rates decreased. The SRA reading program was started on 1/11/71 with Clara in Book A and her initial correct reading rate was 49 per minute. Her error rate was 7 per minute. At termination she was reading 71 correct words per minute, with 0 errors in Book D.

5. Gary W. began Sullivan Book 2 on 9/28/70 with a correct responding rate of 5.0 letters per minute. His error rate was .34 letters per minute. At termination he was working on Book 10 with a correct rate of 8.6 letters per minute and an error rate of .08 letters per minute. Gary started in Suppes Math Book 1 on 9/24/70 with an initial rate of 4.8 numbers correct per minute, and a .1 error rate per minute. At termination Gary was working on Sullivan Math Book 4 (Multiplication) at a correct responding rate of 6.2 and an error rate of .03. At the end of the school year Gary was working on basic multiplication and division facts. The SRA Reading program was started on 1/11/71 with Gary in Book A and his initial correct reading rate was 67 per minute. His error rate was 4 per minute. At termination he was reading 82 correct words per minute, with 0 errors in Book E. Gary's correct rate trends continued to rise with an increase in material difficulty, while his error rates decreased.

6. Robert M. began Sullivan Book 1 on 2/17/71 at a correct Write-letter responding rate of 7.0 letters per minute. His error rate was .2 letters per minute. At termination he was working on Book 10 with a correct rate of 8.5 letters per minute and an error rate of .06 letters per minute. Robert started Suppes Math Book K on 1/28/70 at initial rates of 8 numbers correct per minute and .17 errors per minute. At termination, he was in Sullivan Book 4 and responding at a 5.5 per minute correct rate with a .06 error rate. His multiplication and division skills were at grade level at the termination of this project. The SRA reading program was started on 2/25/71 with Robert in Book A and his initial correct reading rate was 45 per minute. His error rate was 3 per minute. At termination he was reading 100 correct words per minute, with 0 errors in Book F. Robert's correct rate trends continued to rise with an increase in material difficulty, while his error rates decreased.

7. Gregg E. began Sullivan Book 1A on 2/25/71 with a correct Write-letter responding rate of 7.0 letters per minute. His error rate was .48 letters per minute. At termination he was working in Book 8 with a correct rate of 6.0 letters per minute and an error rate of .15 letters per minute. Gregg

started Suppes Math Book I on 1/28/70 at initial rates of 8 numbers correct per minute and .2 errors per minute. At termination he was in Sullivan Book 4, responding at a 5 per minute correct rate and a .06 error rate. His multiplication and division skills were at grade level and re-entry into a regular classroom situation was projected for fall term. The SRA reading program was started 2/25/70 with Gregg in Book A and his initial correct reading rate was 55 per minute. His error rate was 5 per minute. At termination Gregg was reading 70 correct words per minute, with 1.1 errors in Book F. Gregg's correct rate trends continued to rise with an increase in material difficulty, while his error rates decreased.

8. Betty H. began Sullivan Book IA on 2/2/70 with a correct Write-letter responding rate of 2.5 letters per minute. Her error rate was .35 letters per minute. At termination she was working in Book 5 with a correct rate of 4.0 letters per minute. At termination she was correctly reading 40 words per minute with 1.5 errors per minute. Betty started Suppes Math Book I on 2/2/70 at initial rates of 5 numbers correct per minute and 1.4 errors per minute. At termination she was in Sullivan Book 4 responding at a 5 per minute correct rate and a 0 error rate. Her multiplication and division skills are at grade level.

9. Clarence F. started in Suppes Math Book I on 9/24/70 at initial rate of 3.5 correct per minute, and .42 errors. At termination he was working on the latter part of Book 2 and was responding at a 6.7 per minute correct rate with a .01 error rate. Clarence began the SRA Reading program on 1/11/71 in Book A with an initial correct reading rate of 31 words per minute and an error rate of 4 words per minute. At termination Clarence was reading 43 correct words per minute with a 1.5 error rate in Book C.

10. Ron S. began Sullivan Book I on 10/14/70 with a correct Write-letter responding rate of 2.1 letters per minute. His error rate was .07 letters per minute. At termination Ron was working in Book 3 with a correct rate of 4.1 letters per minute and an error rate of .03 letters per minute. Ron started in Suppes Math Book I on 9/29/70 at initial rates of 2.0 numbers correct per minute and .16 errors per minute. At termination he was working on the latter part of Book 2 and was responding at a 7.2 per minute correct rate with a .01 error rate. Ron began the SRA reading program on 1/11/71 in Book A with an initial correct reading rate of 41 words per minute and an error rate of 6 words per minute. At termination Ron was reading 52 correct words per minute with a 1.7 error rate in Book C.

11. Alfred B. began the Sullivan pre-reader on 1/8/71 with a correct Write-letter responding rate of 3.8 letters per minute. Alfred's error rate was .12 letters per minute. At termination Alfred was working in Book 3 with a correct rate of 6.1 letters per minute and an error rate of .04 letters per minute. Alfred started in Suppes Math Book I on 9/24/70 at initial rates of 4.1 numbers correct per minute, and .17 errors per minute. At termination he was working on the latter part of Book 2 and was responding at a 5.2 per minute correct rate with a .02

error rate. The SRA reading program was started on 1/11/71 with Alfred in Book A. He had an initial correct reading rate of 32 words per minute with an error rate of 2 words per minute. At termination Alfred was reading 48 correct words per minute, with 0 errors in Book B.

12. Coe N. started in Suppes Math Book K on 9/24/70 at initial rates of 3.0 correct per minute, and .4 errors per minute. At termination Coe was in Book 2 and was responding at a 5.1 per minute correct rate with a .05 error rate. Coe began the SRA reading program on 1/11/71 in Book A with an initial correct reading rate of 28 words per minute and an error rate of 6 words per minute. At termination Coe was reading 39 correct words per minute with a 0 error rate in Book B.

13. Debbie S. began Sullivan Book 1A on 1/4/71 with a correct Write-letter responding rate of 3.0 letters per minute. Her error rate was .12 letters per minute. At termination Debbie was working in Book 2 with a correct rate of 3.5 letters per minute and an error rate of .04 letters per minute. Debbie's initial Sullivan reading rate was 55 correct words per minute with 2 errors per minute. At termination she was correctly reading 45 words per minute with 0 errors per minute. Debbie started Suppes Math Book K on 1/26/70 at initial rates of 4 numbers correct per minute and .04 errors per minute. At termination Debbie was in Sullivan Math Book 4 responding at a 3 per minute correct rate and a .04 error rate.

14. Jackie S. began Sullivan Book 1A on 1/4/71 with a correct Write-letter responding rate of 4.5 letters per minute. Her error rate was .2 letters per minute. At termination Jackie was working in Book 3 with a correct rate of 3.0 letters per minute and an error rate of .15 letters per minute. Jackie started Suppes Math Book K on 9/23/70 at initial rates of 3 numbers correct per minute and .2 errors per minute. At termination Jackie was in the latter part of Book 2 responding at a 2.5 per minute correct rate and a 0 error rate.

15. Bobby R. began Sullivan Book 1A on 1/4/71 with a correct Write-letter responding rate of 3.5 letters per minute. Bobby's error rate was .1 letters per minute. At termination he was working in Book 3 with a correct rate of 5.5 letters per minute and an error rate of 0 letters per minute. Bobby's initial Sullivan reading rate was 40 correct words per minute with 0 errors per minute. At termination he was correctly reading 55 words per minute with 0 errors per minute. Bobby started Suppes Math Book K on 1/26/70 at initial rates of 3 numbers correct per minute and .2 errors per minute. At termination he was in the latter half of Suppes Book 2 responding at a 3 per minute correct rate and a .05 error rate.

16. Julie H. began Sullivan Book 1A on 1/4/71 with a correct Write-letter responding rate of 3.0 letters per minute. Her error rate was .15 letters per minute. At termination Julie was working in Book 3 with a correct rate of 4.0 letters per minute and an error rate of .05 letters

per minute. Julie's initial Sullivan oral reading rate was 45 words per minute correct, with 3 errors. At termination she was reading correctly 50 words per minute, with 0 errors. Julie started Suppes Math Book 1 on 10/12/70 at an initial rate of 3 numbers correct per minute with .2 errors per minute. At termination she was in the latter half of Book 2 responding at a 3 per minute correct rate and a 0 error rate.

17. Robert B. began Sullivan Book 1A on 1/4/71 with a correct Write-letter responding rate of 3.5 letters per minute. Robert's error rate was .05 letters per minute. At termination he was working in Book 3 with a correct rate of 5.5 letters per minute and an error rate of .02 letters per minute. Robert's initial Sullivan reading rate was 40 correct words per minute with 0 errors per minute. Robert started Suppes Math Book K 9/23/70 at initial rates of 3 numbers correct per minute and .16 errors per minute. At termination he was in the latter half of Suppes Book 2 responding at a 4 per minute correct rate and a .04 error rate.

18. Arvel M. started Suppes Math Book K on 9/21/70 at initial rates of 2.4 numbers correct per minute and .12 errors per minute. At termination he was in the latter half of Suppes Book 2 responding at a 4.1 per minute correct rate and a .05 error rate.

19. Patrick C. started in Suppes Math Book K on 9/24/70 at initial rates of 1.5 correct per minute, and .15 errors per minute. At termination Patrick was in Book 2 and was responding at a 3.5 per minute correct rate with a .05 error rate. Patrick began the SRA reading program on 1/11/71 in Book A with an initial correct reading rate of 30 words per minute. At termination Patrick was reading 46 correct words per minute with a 2 error rate in Book B.

20. Juanita A. began Sullivan Book 1A on 1/4/71 with a correct Write-letter responding rate of 40 letters per minute. Juanita's error rate was .12 letters per minute. At termination she was working in Book 2 with a correct rate of 2.5 letters per minute and an error rate of 0 letters per minute. Juanita's initial Sullivan reading rate was 24 correct words per minute with 3 errors per minute. At termination she was correctly reading 30 words per minute with 0 errors per minute. Juanita started Suppes Math Book K on 9/28/70 at initial rates of .7 numbers correct per minute and .4 errors per minute. At termination she was in the latter half of Suppes Book 2 responding at a 5.5 per minute correct rate and a 0 error rate.

21. Steve N. began Sullivan Book 1 A on 3/15/71 with a correct Write-letter responding rate of 3.2 letters per minute. Steve's error rate was 1.6 letters per minute. At termination he was working in Book 2 with a correct rate of 4.1 letters per minute and an error rate of 0 letters per minute. Steve's initial Sullivan reading rate was 27 correct words per minute with 5 errors per minute. At termination he was correctly reading 36 words per minute with 2 errors per minute. Steve started Suppes Math Book K on 10/26/70 at initial rates of 2.3 numbers correct per minute and .17 errors per minute. At termination he was in the latter half of Suppes Book 2 responding at a 5.1 per minute correct rate and a .02 error rate.

22. Georgene W. began Sullivan Book IA on 1/4/71 with a correct Write-letter responding rate of 2.3 letters per minute. Georgene's error rate was .06 letters per minute. At termination she was working in Book I with a correct rate of 40 letters per minute and an error rate of 0 letters per minute. Georgene's initial Sullivan reading rate was 18 correct words per minute with 8 errors per minute. At termination she was correctly reading 31 words per minute with 1 error per minute. Georgene started Suppes Math Book K on 2/2/70 at initial rates of 1.3 numbers correct per minute and .12 errors per minute. At termination she was in the latter half of Suppes Book 2 responding at a 2.1 per minute correct rate and a .03 error rate.

23. Gary W. began Sullivan Book IA on 1/4/71 with a correct Write-letter responding rate of 3.5 letters per minute. Gary's error rate was .25 letters per minute. At termination he was working in Book 2 with a correct rate of 4.1 letters per minute and an error rate of .07 letters per minute. Gary's initial Sullivan reading rate was 23 correct words per minute with 6 errors per minute. At termination he was correctly reading 41 words per minute with 2 errors per minute. Gary started Suppes Math Book K on 9/21/70 at an initial rate of 1.2 numbers correct per minute and .21 errors per minute. At termination he was in the latter half of Suppes Book 2 responding at a 3.6 per minute correct rate and a .04 error rate.

DISCUSSION AND CONCLUSIONS

Results

The results presented in the preceding section enable us to evaluate the effectiveness of three important instructional objectives of the Tacoma Project: the systematic arrangement of instructional cues in order to promote efficient development of academic skills and to establish a replicable program; the use of contingency management; and the measurement of performance which is based on continuous collection and examination of data. Data relating to the second and third objectives provide direct evidence of the Tacoma Project's effectiveness in significantly changing student academic behavior; data concerning the first objective yield indirect evidence of success.

Evaluation of systematic arrangements of instructional cues. The comparisons of student performance in reading, spelling, and math on the WRAT pre- and posttests show that the experimental classes made significant academic growth in the two subject areas (reading and math) which had been programmed to provide a systematic arrangement of instructional cues. More direct evidence of the effectiveness of the programmed materials was the consistently low rate of error responses made in material which was increasing in complexity. Students' achievement of errorless learning was frequently shown on the graphs; students who achieved errorless learning were usually able to maintain it.

Evaluation of contingency management. Comparisons of students' performance during baseline conditions and after intervention show that students made significant decreases in error responses following the implementation of reinforcement contingencies.

Evaluation of measurement procedures. Comparisons of morning and afternoon performance in Suppes math, of session one and session two in Sullivan programmed reading, and of performance in Suppes Math Books 1 and 2 provide a comprehensive analysis of student performance, the information for which would not have been furnished by any method other than continuous measurement. For instance, the Sullivan graphs revealed that students in the Tacoma Project performed as well during the second half of the period as they did during the first half--information that contradicts some conventional notions about students' fatigue and short attention spans.

Discussion

In the Tacoma Project, investigators applied the techniques of precision teaching in classrooms for children who had been labeled mentally retarded. These techniques included: systematic arrangement of instructional cues, the technology of programmed learning, careful management of reinforcement contingencies, and accurate, continuous measurement of performance in order to evaluate the total instructional process. The Project has shown that such instruction made a significant difference in students' academic performance. Indeed, it has clearly demonstrated that this particular population of students was capable of

exceeding society's expectations, i.e.,a high percentage of the students (30%) were ready to be transferred to regular classes after their year's experience in a program of systematic intervention.

Although the discussion so far has concerned improved student performance, the investigators have little doubt that the techniques used in the Project enabled the teachers to become more efficient and effective in their work. The behavior of a child in a classroom is controlled by the contingencies operating in that environment; the child in turn operates on the environment to bring about gratifying events. The student knows, for instance, that if he completes his math he can go outside for recess, but that if he often jumps out of his seat during math, he cannot. The teacher who consciously manages the contingencies of the environment--the events that are antecedent and consequent to behavior and that influence it--can modify student behaviors, thereby increasing the rate of desirable ones and diminishing or extinguishing undesirable ones. By pinpointing behaviors, by continuously measuring their occurrence, by charting and analyzing data concerning those behaviors, the teacher is able to assess the effectiveness of his contingency management. It is through the use of these techniques that a teacher can make objective educational decisions and be freed from reliance on hunches, guesses, and other subjective, possibly inaccurate, judgments about a student's progress. In classes for children with academic and social response deficits--children who already bear labels concerning their expected performance--such objectivity is especially important.

It is not surprising that a systematic application of principles of reinforcement would result in increased academic achievement. This has been demonstrated in many studies. The significance of this study stems from the attention to all details involved in the application of this principle in the natural setting, the almost infinite number of decisions which are required of the teacher to insure that each child is receiving an instructional program and an environment for learning that is best suited to him. Further, for the sake of replication, a very complete description of the procedures involved throughout has been included.

Although the success of contingency management is graphically demonstrated by the Tacoma Project, the scope of the project was not limited to the practice of such management by experimenters in a special class. It included the continuous training of regular classroom teachers who learned to use the procedures of continuous recording, charting and analysis of data in addition to the principles of contingency management and the application of such principles in their classrooms.

The ultimate aim of the teacher who manipulates contingencies is to build and strengthen in children those behaviors that are appropriate to the classroom. Among such behaviors are those that will eventually give the child the skills to manage his own environment. Teaching self-management skills is, therefore, an important part of the strategy of contingency management. The child in the example we mentioned earlier--the child who knows that if he works on his math he can earn recess--is the one who is to some extent controlling his educational environment, and he can work as the teacher's partner in establishing the conditions under which he learns. The teacher who makes

decisions which enhance a student's self-management skills knows that an undesirable behavior can be eliminated simply by strengthening a desirable behavior that is incompatible with it. He knows, too, that the selection of appropriate cues which evoke the desired behavior is required. Finally, he knows that a relatively minor modification of an environment can bring about a large improvement in performance. With this knowledge, the teacher can arrange conditions so that each child learns at his optimum pace. The experimenters believe that such conditions were amply demonstrated in the Tacoma classrooms.

This project also revealed that such widely used programmed materials as Sullivan and Suppes did produce an unwarranted rate of errors. Whether or not it is indeed possible to produce error-free instructional programs--or for that matter whether or not error-free instruction is necessary or desirable--remains an important question. The critical point here is that commercially prepared programs have many irregularities in format, sequence, increments of information, skill required, and response expectations. These irregularities exist in spite of every effort on the part of the teacher to supplement the instruction and are the most important source of errors in the child's performance. The analysis of correct and error rates indicated that excessive errors in the performance of these children did produce lower correct performance rates and slowed progress toward the instructional objectives.

To summarize, the academic performance of students as well as the efficiency and effectiveness of teachers can be improved through technology. A teacher who can use the procedures of precision teaching (precise pinpointing of behaviors, continuous measurement of rates of occurrence, graphic display of data, and analysis of data) can accurately assess the effects of classroom variables, control them, and consequently be effective in his manipulations of the classroom environment. For the teacher willing to make the commitment, precision teaching guarantees him the professional role of making data-based, functional decisions which, because of their objectivity, clearly enhance and protect the individuality and the capabilities of his students.

Addendum

Ten weeks after the 1971-72 school year began, David Krug made a site visit to the Tacoma School District for three reasons: to gather data for the follow-up study; to determine informally teachers' opinions of the academic and social progress of the eight Project students who were placed in regular classes; and to determine to what extent the experimental classroom teachers were still using precision teaching techniques they had been trained to use during the two years of the Project.

Follow-up. Results obtained from follow-up tests--which evaluate students' ability to generalize academic gains they have made in the experimental condition to other settings--will be described in detail in the follow-up report.

Informal evaluation. In informal talks, the teachers who are now working with students transferred from the experimental classes unanimously made favorable comments about students' behavior and academic performance. For example, one sixth grade teacher, who has two of the boys in his classroom, said: "Greg and Bob are holding their own academically. In fact, in multiplication they are ahead of the rest of the class. They present no problems behaviorally." Another teacher said about the student in her class: "No problem, Clara is doing just great!" These comments were typical of the responses from all the teachers interviewed. Such informal reactions are not presented as proof that students' academic and behavioral gains in performance, achieved in the experimental classes, have been generalized and maintained in other settings. That information will have to come from the tests to be administered this year. However, the observations and anecdotal information are cited to show that student adjustment--as perceived by the students' teachers--has so far been an unreserved success.

Precision teaching techniques. The two experimental classroom teachers from the Tacoma School District were Mary O'Leary and Susan Soli. Mary O'Leary is continuing to teach in a self-contained Special Education classroom and is training student teachers in the procedures and techniques of precision teaching. In addition, she is sharing her expertise with the other Special Education teachers in her school building. Susan Soli is working with the Tacoma School District's Special Education Administration staff as a training consultant to Special Education teachers. In this capacity she is training teachers to use precision teaching procedures and techniques.

This initial follow-up site visit suggests three tentative conclusions:

1. Students have been able to maintain the gains they made in the experimental condition and to transfer these gains to new settings.
2. Students have also been able to generalize to new settings the behavioral improvements they achieved in the experimental condition.
3. The Tacoma School District Administration is using productively the training and experience gained by the experimental classroom teachers during the Project's two years.

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Final Report Certification

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Contract Officer	Project Director
Date	Date

APPENDIX A

SUMMARIES OF INDIVIDUAL SKILLS ACQUISITION

Entering Behaviors		Behaviors at Termination
1. Say Letters (Distar) Could recognize:		1. Say letters (Distar) Could recognize:
Robert M	all letters	all letters
Greg E	a,b,c,d,e,f,h,k,l,m,p,r,t,w	all letters
Betty H	a,b,c,d,e,f,m,s,t,y	all letters
Gary W	all letters	all letters
Clara M	all letters	all letters
Doug B	a,b,d,e,f,g,i,k,l,m, p,r,s,t,u,w,y	all letters
June T	all letters	all letters
Robert D	a,b,c,d,e,f,h,i,l,m, o,s,t,y,z	all letters
Clarence F	a,b,c,d,e,i,j,q,t,w,x,y,z	m,d,a,s,e,f,r,i,c,o,n,a,h, u,b,j,o,w,x,y,z
Ron S	a,b,c,d,e,f,g,k,m,r,s,t,x	m,d,s,a,e,f,r,i,t,ahu, gon l,w,k,u,p,b,y,s,c,d,k,y
Arvel M	s,f,a,r,m,e,b	m,d,u,s,e,f,r,i,t,h,u,c,o,n
Alfred B	h,n,u,s,o,c,f,a,i,r,t,g,l m,d,e	all letters
Coe M	h,n,s,o,c,f,a,i,t,l,m,e,e,o	m,d,a,s,f,r,i,c,o,n,t,a,h,u g,l,w,i,k,o,u,e
Bobby R		m,a,c,f,r,i,d,c,o,n,t,h,u, g,l,w,k,p,u,t,o,y,w,z
Julie H	all letters	all letters
Gary W		m,a,s,e,f,t,n,t,h,u,g,o,w, k,o,u,p,y,
Julie W		m,c,o,n,i,t,a,h,u,g,l,w,i, k,u,p,e,b
Jackie S		m,a,s,e,r,i,d,f,c,o,n,t,h, u,g,l,w,y,x,p,z,k,m,u
Juanita A		m,a,s,e,f,d,r,i,c,o,n,t,h, u,g,l,w,o,p
Debbie S		m,a,s,e,f,d,r,i,c,o,n,t,h,u, g,l,w,k,i,o,p,y,j,x,z

READIIIG SKILLS

Entering Behaviours		Behaviours at Termination
II. Say Sounds (Distar Could recognize:		II. Say Sounds (Distar) Could recognize:
Robert M	a,b,c,d,e,h,k,l,m,p, r,s,t,y,z	all sounds
Greg E	a,b,e,k,l,m,s,t	all sounds
Betty H	a,e,m,s	all sounds
Gary W	a,b,c,d,e,f,m,y,s,t	all sounds
Clara M	a,b,d,e,h,k,l,m,n,p, r,s,t,z	all sounds
Doug B	a,b,m,p	all sounds
June T	a,b,d,e,h,k,l,m,p,r, s,t,w	all sounds
Robert D	a,d,f,h,m,s,t	all sounds
Clarence F	a,b,d,t	m,d,a,s,e,f,r,i,t,con,ahug,lus k,o,u,b,j,q,w,x,y,z
Ron S	a,b,c,g,m,s	m,d,s,a,e,f,r,i,tahu, gon, l,w, cup,b,y,s,c,d,k,y
Arvel M	m,e,d,a,f,c,	m,d,a,s,e,f,r,i,th,hu,one
Fred B	e,d,o,h,i,c,n,t,s,f	all sounds
Coe M	n,p,d,h,w,o,l,q,n,t, the,f,a,u	m,d,a,s,f,r,i,c,o,n,t,a,h,u,g,l, w,i,k,o,u,e
Bobby R		mac,fri,con,th,u,gl,w,k,p,u,j,x, o,you,w,z
Julie H		all sounds
Gary W		mase,fri,n,th,u,gl,w,k,o,u,p,y,j
Julie W		mase,d,r,i,c,o,h,u,g,l,u,s,i,k,b y,j,u,p
Jackie S		mase,rid,f,con,th,a,gl,w,y,x,o,z, k,m,u
Juanita A		mase,f,d,r,i,con,th,u,gl,w,up
Debbie S		mase,fr,i,d,con,th,u,gl,w,k,o,u,p, y,j,x,ou,z

READING SKILLS

	Entering Behaviors			Behaviors at Termination		
	Write Letters (Sullivan) BK#	Correct Rate	Error Rate	Write Letters (Sullivan) Bk#	Correct Rate	Error Rate
Robert M	1A	7.0	.2	10	8.5	.06
Greg E	1A	7.0	.48	8	6.1	.15
Betty H	1A	9.0	.06		5.2	.05
Gary W	2	5.0	.34	10	6.1	.08
Clara M	1A	3.0	.14	8	8.6	.15
Doug B	1	4.5	.35	7	8.3	.2
June T	1	5.0	.1	7	5.5	.02
Robert D	1A	4.0	.9	3	5.1	.06
Clarence F	1A	5.0	.12	2	4.5	.13
Ron S	1	2.1	.07	3	4.1	.03
Arvel M	no rates					
Fred B	1A	3.8	.12	3	6.1	.04
Coe M	1A	3.0	.05	1	2.9	.06
Bobby R	1A	3.5	.10	3	5.5	.00
Julie M	1A	3.0	.15	3	4.0	.05
Gary W	1A	2.3	.06	1	4.0	.00
Julie W	1A	4.5	.9	2	4.0	.05
Jackie S	1A	4.5	.15	3	8.0	.00
Juanita A	1A	2.7	.2	2	1.0	.00
Debbie S	1A	3.0	.12	2	3.5	.04

READING SKILLS

	Entering Behaviors			Behaviors at Termination		
	Oral Reading (Sullivan) BK#	Correct Rate	Error Rate	Oral Reading (Sullivan) BK#	Correct Rate	Error Rate
Robert M	1A	55	3	10	130	0
Greg E	1A	55	6	8	95	2
Betty H	1A	35	4	5	65	0
Gary W	2	45	2	10	85	0
Clara M	1A	50	1	8	95	0
Doug B	1	40	2	7	65	0
June T	1	24	3	7	50	0
Robert D	1A	65	0	3	120	0
Clarence F	1A	25	0	2	40	0
Ron S	1	35	0	3	45	0
Arvel M	no rates					
Fred B	1A	35	0	3	55	0
Coe N	1A	20	0	1	40	0
Bobby R	1A	40	0	3	55	0
Julie H	1A	45	3	3	60	0
Gary W	1A	18	8	1A	31	1
Julie W	no rates					
Jackie S	no rates					
Juanita A	no rates					
Debbie S	1A	55	2	2	45	0

READING SKILLS

	Entering Behaviors			Behaviors at Termination		
	Oral Reading (SRA) BK#	Correct Rate	Error Rate	Oral Reading (SRA) BK #	Correct Rate	Error Rate
Robert M	A	45	5	F	108	0
Greg E	B	61	10	E	72	4
Betty H	A	55	2	E	70	0
Gary W	A	67	4	D	82	0
Clara M	A	49	7	D	71	0
Doug B	A	56	6	C	63	0
June T	A	40	5	C	51	0
Robert D	A	63	3	C	96	0
Clarence F	A	31	4	B	43	0
Ron S	A	41	6	B	52	0
Arvel M	no rates					
Fred B	A	32	2	B	48	0
Coe N	A	28	6	B	39	0
Bobby R	A	45	2	C	95	0
Julie H	no rates					
Gary W	A	33	5	B	75	2
Julie W	A	40	4	C	80	0
Jackie S	no rates					
Juanita A	no rates					
Debbie S	A	50	4	C	110	0

MATH SKILLS CHECK LIST (95% Accuracy)

Name Robert S.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5	X	X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		
8. Geometry:		
a. Measurement		X
b. Construction		X

Math Skills Checklist (95% Accuracy) Robert S.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s		X
2. Difference of Sets		X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		X
9. Regrouping In Addition		X
10. Geometry		
11. Regrouping in Sub		
12. Fractions		
13. Equations		
14. Multiplication		
15. Area		
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name June T.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets	X	X
2. Adding #'s 1-5	X	X
3. Difference of Sets	X	X
4. Subtracting #'s	X	X
5. Adding #'s 6-10	X	X
6. Tens and ones	X	X
7. Number Sentences		X
8. Geometry:		
a. Measurement	X	X
b. Construction	X	X

Math Skills Checklist (95% Accuracy)

JUNE T.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s	X	X
2. Difference of Sets	X	X
3. Subtraction of #'s	X	X
4. Add & Sub	X	X
5. Tens & Ones	X	X
6. #'s 11 to 19	X	X
7. 100's 10's and ones	X	X
8. Less than	X	X
9. Regrouping In Addition		X
10. Geometry	X	X
11. Regrouping in Sub		X
12. Fractions		X
13. Equations	X	X
14. Multiplication	X	X
15. Area		X
16. Word Problems		X

MATH SKILLS CHECK LIST (95% Accuracy)

Name Robert M.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two		X
3. Larger - Shorter	X	X
4. #'s to three		X
5. Matching Shapes	X	X
6. #'s to five		X
7. Counting Pennies		X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5		X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		X
8. Geometry:		
a. Measurement		X
b. Construction		X

Math Skills Checklist (95% Accuracy)

Robert M.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s		X
2. Difference of Sets		X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		
9. Regrouping in Addition		X
10. Geometry		X
11. Regrouping in Sub		X
12. Fractions		
13. Equations		
14. Multiplication		X
15. Area		
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name Clarence F.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets	X	X
2. Adding #'s 1-5	X	X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10	X	X
6. Tens and ones		X
7. Number Sentences		
8. Geometry:		
a. Measurement		X
b. Construction		X

Math Skills Checklist (95% Accuracy)

Clarence F.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s	X	X
2. Difference of Sets	X	X
3. Subtraction of #'s	X	X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		
9. Regrouping In Addition		X
10. Geometry		
11. Regrouping in Sub		
12. Fractions		
13. Equations		
14. Multiplication		
15. Area		
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name Patrick C.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller		X
2. #'s to two		X
3. Larger - Shorter		X
4. #'s to three		X
5. Matching Shapes		X
6. #'s to five		X
7. Counting Pennies		X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5		X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		
6. Tens and ones		
7. Number Sentences		
8. Geometry: a. Measurement b. Construction		

Math Skills Checklist (95% Accuracy)

Patrick C.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s		X
2. Difference of Sets		X
3. Subtraction of #'s		
4. Add & Sub		
5. Tens & Ones		
6. #'s 11 to 19		
7. 100's 10's and ones		
8. Less than		
9. Regrouping In Addition		
10. Geometry		
11. Regrouping in Sub		
12. Fractions		
13. Equations		
14. Multiplication		
15. Area		
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name Robert D.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five		X
7. Counting Pennies		X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5		X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		
8. Geometry:		
a. Measurement	X	X
b. Construction	X	X

Math Skills Checklist (95% Accuracy) Robert D.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s		X
2. Difference of Sets		X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		X
9. Regrouping In Addition		X
10. Geometry		X
11. Regrouping in Sub		X
12. Fractions		X
13. Equations		
14. Multiplication		X
15. Area		X
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name Doug B.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets	X	X
2. Adding #'s 1-5	X	X
3. Difference of Sets	X	X
4. Subtracting #'s	X	X
5. Adding #'s 6-10	X	X
6. Tens and ones	X	X
7. Number Sentences		X
8. Geometry:		
a. Measurement	X	X
b. Construction	X	X

Math Skills Checklist (95% Accuracy)

Doug B.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s	X	X
2. Difference of Sets		X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		X
9. Regrouping In Addition		X
10. Geometry		X
11. Regrouping in Sub		X
12. Fractions		X
13. Equations		
14. Multiplication		X
15. Area		X
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name Juanita A.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5		X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		
8. Geometry: a. Measurement b. Construction		X X

Math Skills Checklist (95% Accuracy)

Juanita A.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s		x
2. Difference of Sets S		X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		X
9. Regrouping In Addition		X
10. Geometry		
11. Regrouping In Sub		
12. Fractions		
13. Equations		
14. Multiplication		
15. Area		
16. Word Problems		

Math Skills Checklist (95% Accuracy)

Arvel M.

Skill Presentation Order BK-2	Entering Behaviours	Behaviours At Termination
1. Addition of #'s		X
2. Difference of Sets		X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		
6. #'s 11 to 19		
7. 100's 10's and ones		
8. Less than		
9. Regrouping In Addition		
10. Geometry		
11. Regrouping in Sub		
12. Fractions		
13. Equations		
14. Multiplication		
15. Area		
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name Arvel M.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two		X
3. Larger - Shorter	X	X
4. #'s to three		X
5. Matching Shapes	X	X
6. #'s to five		X
7. Counting Pennies		X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5		X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		
8. Geometry: a. Measurement b. Construction		

Math Skills Checklist (95% Accuracy)

Julie H.

Skill Presentation Order BK2	Entering Behaviours	Behaviours At Termination
1. Addition of #'s	X	X
2. Difference of Sets		X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		X
9. Regrouping In Addition		X
10. Geometry		X
11. Regrouping in Sub		X
12. Fractions		X
13. Equations		
14. Multiplication		X
15. Area		
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy) Name Julie H.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets	X	X
2. Adding #'s 1-5	X	X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		X
8. Geometry:		
a. Measurement		X
b. Construction		X

Math Skills Checklist (95% Accuracy)

Skill Presentation Order BK-2	Entering Behaviours	Behaviours At Termination
1. Addition of #'s		X
2. Difference of Sets		X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		X
9. Regrouping In Addition		X
10. Geometry		X
11. Regrouping in Sub		
12. Fractions		
13. Equations		
14. Multiplication		
15. Area		
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name Jackie S.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5	X	X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		
8. Geometry:		
a. Measurement		X
b. Construction		X

Math Skills Checklist (95% Accuracy)

Robert B.

Skill Presentation Order	BK-2	Entering Behaviours	Behaviours At Termination
1. Addition of #'s			X
2. Difference of Sets			X
3. Subtraction of #'s			X
4. Add & Sub			X
5. Tens & Ones			X
6. #'s 11 to 19			X
7. 100's 10's and ones			X
8. Less than			X
9. Regrouping In Addition			X
10. Geometry			X
11. Regrouping in Sub			X
12. Fractions			X
13. Equations			
14. Multiplication			X
15. Area			
16. Word Problems			

MATH SKILLS CHECK LIST (95% Accuracy)

Name Robert B.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		X
1. Union of Sets		X
2. Adding #'s 1-5	X	X
3 Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		X
8. Geometry: a. Measurement b. Construction		X X

Math Skills Checklist (95% Accuracy)

Robert B.

Skill Presentation Order	BK-2	Entering Behaviours	Behaviours At Termination
1. Addition of #'s			X
2. Difference of Sets			X
3. Subtraction of #'s			X
4. Add & Sub			X
5. Tens & Ones			X
6. #'s 11 to 19			X
7. 100's 10's and ones			X
8. Less than			X
9. Regrouping in Addition			X
10. Geometry			X
11. Regrouping in Sub			X
12. Fractions			X
13. Equations			
14. Multiplication			X
15. Area			
16. Word Problems			

MATH SKILLS CHECK LIST (95% Accuracy)

Name Robert B.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5	X	X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		X
8. Geometry:		
a. Measurement		X
b. Construction		X

Math Skills Checklist (95% Accuracy) Greg E.

Skill Presentation Order BK-2	Entering Behaviours	Behaviours At Termination
1. Addition of #'s	X	X
2. Difference of Sets		X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		X
9. Regrouping In Addition		X
10. Geometry		X
11. Regrouping in Sub		X
12. Fractions		
13. Equations		X
14. Multiplication		X
15. Area		X
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name Greg E.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5	X	X
3. Difference of Sets	X	X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		X
8. Geometry: a. Measurement b. Construction		X X

MATH SKILLS CHECK LIST (95% Accuracy)

Name Alfred B.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two		X
3. Larger - Shorter		X
4. #'s to three		X
5. Matching Shapes	X	X
6. #'s to five		X
7. Counting Pennies		X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5	X	X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		
8. Geometry: a. Measurement b. Construction		

Math Skills Checklist (95% Accuracy) Alfred B.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s		X
2. Difference of Sets		X
3. Subtraction of #'s		
4. Add & Sub		
5. Tens & Ones		
6. #'s 11 to 19		
7. 100's 10's and ones		
8. Less than		
9. Regrouping In Addition		
10. Geometry		
11. Regrouping in Sub		
12. Fractions		
13. Equations		
14. Multiplication		
15. Area		
16. Word Problems		

Math Skills Checklist (95% Accuracy)

JULIE W.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s		X
2. Difference of Sets		X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		X
9. Regrouping In Addition		
10. Geometry		X
11. Regrouping in Sub		
12. Fractions		
13. Equations		
14. Multiplication		
15. Area		
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name JULIE W.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two		X
3. Larger - Shorter	X	X
4. #'s to three		X
5. Matching Shapes	X	X
6. #'s to five		X
7. Counting Pennies		X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5		X
3. Difference of Sets		
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		
8. Geometry:		X
a. Measurement		X
b. Construction		

Math Skills Checklist (95% Accuracy)

Bobbie R.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s		X
2. Difference of Sets		X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		
9. Regrouping In Addition		X
10. Geometry		X
11. Regrouping in Sub		
12. Fractions		
13. Equations		
14. Multiplication		
15. Area		
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name Bobbie R.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter		X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets	X	X
2. Adding #'s 1-5	X	X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		X
8. Geometry:		
a. Measurement		X
b. Construction		X

Math Skills Checklist (95% Accuracy)

Betty H.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s	X	X
2. Difference of Sets	X	X
3. Subtraction of #'s	X	X
4. Add & Sub	X	X
5. Tens & Ones	X	X
6. #'s 11 to 19		X
7. 100's 10's and ones	X	X
8. Less than		X
9. Regrouping In Addition		X
10. Geometry		X
11. Regrouping in Sub		X
12. Fractions		
13. Equations		X
14. Multiplication		X
15. Area		
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name Betty H.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets	X	X
2. Adding #'s 1-5	X	X
3. Difference of Sets	X	X
4. Subtracting #'s	X	X
5. Adding #'s 6-10	X	X
6. Tens and ones	X	X
7. Number Sentences		X
8. Geometry:		
a. Measurement	X	X
b. Construction	X	X

Math Skills Checklist (95% Accuracy) Gary W.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s		X
2. Difference of Sets		
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		
7. 100's 10's and ones		
8. Less than		
9. Regrouping In Addition		
10. Geometry		
11. Regrouping in Sub		
12. Fractions		
13. Equations		
14. Multiplication		
15. Area		
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name Gary W.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two		X
3. Larger - Shorter		X
4. #'s to three		X
5. Matching Shapes	X	X
6. #'s to five		X
7. Counting Pennies		X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5		X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		
8. Geometry:		
a. Measurement		X
b. Construction		X

Math Skills Checklist (95% Accuracy) Debbie S.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s		X
2. Difference of Sets		X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		X
9. Regrouping In Addition		X
10. Geometry		X
11. Regrouping in Sub		X
12. Fractions		X
13. Equations		X
14. Multiplication		X
15. Area		X
16. Word Problems		X

MATH SKILLS CHECK LIST (95% Accuracy)

Name Debbie S.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5	X	X
3. Difference of Sets		X
4. Subtracting #'s	X	X
5. Adding #'s 6-10	X	X
6. Tens and ones		X
7. Number Sentences		X
8. Geometry:		
a. Measurement		X
b. Construction		X

MATH SKILLS CHECK LIST (95% Accuracy)

Name C. Norval

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets		X
2. Adding #'s 1-5		X
3. Difference of Sets		X
4. Subtracting #'s		X
5. Adding #'s 6-10		X
6. Tens and ones		X
7. Number Sentences		X
8. Geometry:		X
a. Measurement		X
b. Construction		

Math Skills Checklist (95% Accuracy) Coe N.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s		X
2. Difference of Sets		X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		
7. 100's 10's and ones		X
8. Less than		X
9. Regrouping In Addition		X
10 Geometry		X
11. Regrouping in Sub		X
12. Fractions		
13. Equations		X
14. Multiplication		
15. Area		
16. Word Problems		

MATH SKILLS CHECK LIST (95% Accuracy)

Name Gary W.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		
1. Union of Sets	X	X
2. Adding #'s 1-5	X	X
3. Difference of Sets		X
4. Subtracting #'s	X	X
5. Adding #'s 6-10		X
6. Tens and ones	X	X
7. Number Sentences	X	X
8. Geometry:		
a. Measurement	X	X
b. Construction	X	X

Math Skills Checklist (95% Accuracy) Gary W.

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s	X	X
2. Difference of Sets	X	X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones		X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		X
9. Regrouping In Addition		X
10. Geometry	X	X
11. Regrouping In Sub		X
12. Fractions		X
13. Equations		X
14. Multiplication		X
15. Area		X
16. Word Problems		X

MATH SKILLS CHECK LIST (95% Accuracy)

Name R. Mottley

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
Book K:		
1. Bigger - Smaller	X	X
2. #'s to two	X	X
3. Larger - Shorter	X	X
4. #'s to three	X	X
5. Matching Shapes	X	X
6. #'s to five	X	X
7. Counting Pennies	X	X
Book 1:		X
1. Union of Sets	X	X
2. Adding #'s 1-5	X	X
3. Difference of Sets	X	X
4. Subtracting #'s	X	X
5. Adding #'s 6-10	X	X
6. Tens and ones	X	X
7. Number Sentences		X
8. Geometry:	X	X
a. Measurement	X	X
b. Construction		

Math Skills Checklist (95% Accuracy) R. Mottley

Skill Presentation Order	Entering Behaviours	Behaviours At Termination
1. Addition of #'s	X	X
2. Difference of Sets	X	X
3. Subtraction of #'s		X
4. Add & Sub		X
5. Tens & Ones	X	X
6. #'s 11 to 19		X
7. 100's 10's and ones		X
8. Less than		X
9. Regrouping In Addition		X
10. Geometry		X
11. Regrouping in Sub		X
12. Fractions		X
13. Equations		X
14. Multiplication		X
15. Area		X
16. Word Problems		X

APPENDIX B

WORK SHEET SAMPLES

TABLE 1

Overview of Academic Material Organization

Antecedent Condition	Type of Response	Materials	Reinforcement Procedure	Criterion For Change In Program	
Probe testing	Written and Oral	Reading & Math Probe materials	None	Reinforcement	Curriculum
Begin in Book A	Written graphemes, Oral graphemes, and words.	DISTAR Reading Program	Points	When a response rate accelerated to a high accurate rate, reinforcement was changed to a leaner schedule	When Distar Book B was completed a student was started in the Sullivan Programed series.
Book placement dependent on Probe performance	"	Sullivan Books 1-10	Points	If the high accurate rate was maintained, the reinforcement schedule was phased out.	When Distar book C was completed a student moved into the SRA Lab IA.
Begin with first lab booklet	"	SRA Reading Lab	Points		When Suppes Book 2 was completed a student began Sullivan book 4- Multiplication.
Begin with Book A	"	SRA Reading Series Basal reader and Workbook	Points		
Book placement dependent on probe performance	Write numbers	Suppes Math Program	Points		
Return to regular classroom			Teacher and peer reinforcement		

The Antecedent Condition column shows where in the material the student began working. The Type of Response column indicates what movement cycle was measured. The Materials column indicates the material the student is working on. Reinforcement Procedure refers to reinforcers used, and the Criterion For Change columns indicate the type of program changes in reinforcement schedules or curriculum that could be made.

PLAN SHEET # ____ FOR: _____ TARGET A☐ M☐ D☐ Pinpointed by: _____ Pupil ☐ MANAGER ☐ ADVISOR ☐ Date _____

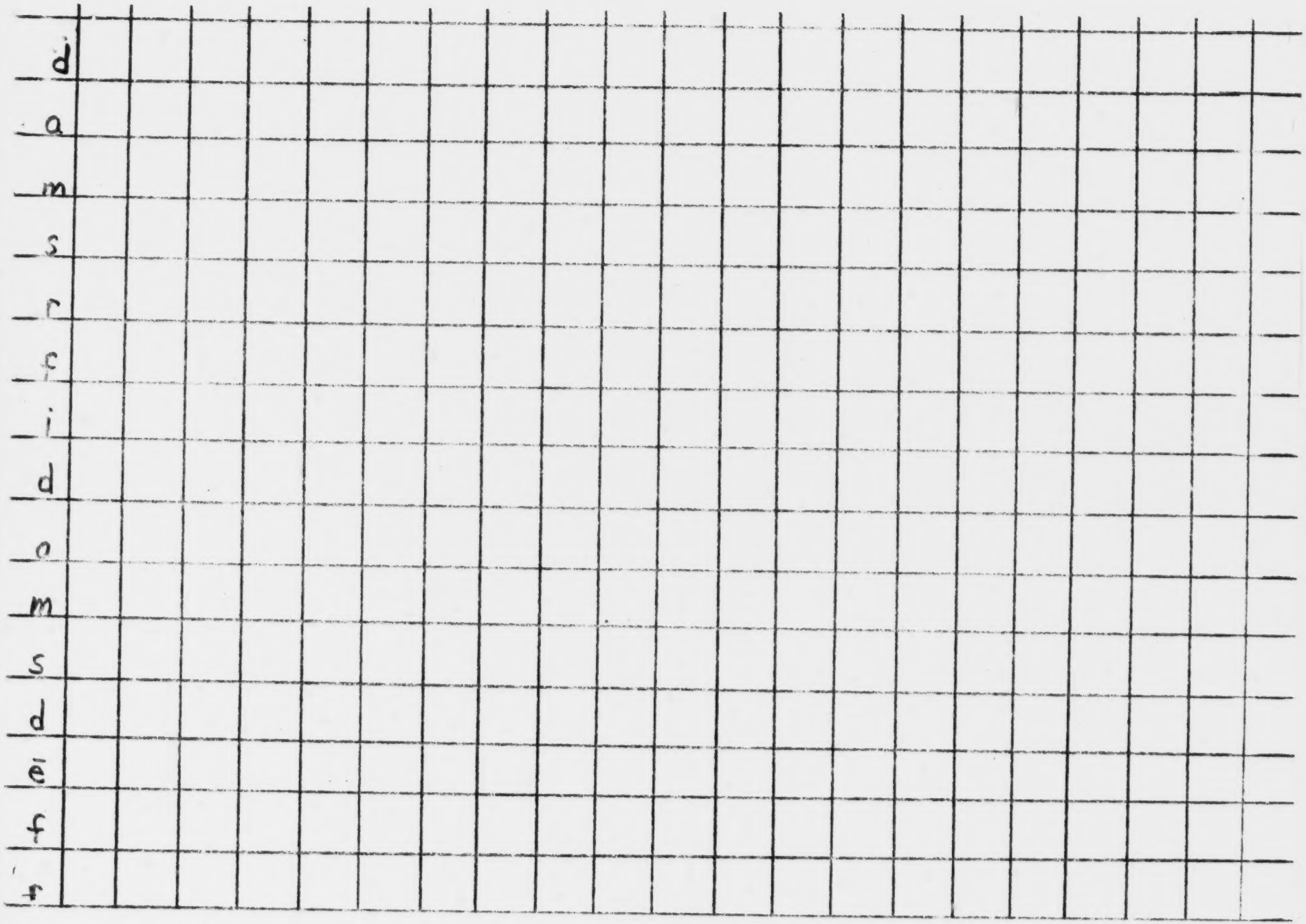
LOCATION: _____ MANAGERS: _____, _____

PROGRAM	E ANTECEDENT	MOVEMENT CYCLE	ARRANGEMENT	E SUBSEQUENT
(Title plus details Time (s) and Dates) Distar Writing Date: _____ Time: _____ to _____ Indiv. Inst. Writing	(Presentation Criteria, i.e. who, what how) Teacher presents stimulus sheets. Teacher records beginning and ending time on event sheet. Students follow examples given in teaching frames. Students raise hand when ready to begin and at the end of each page. Students will write small case letters. Teachers will correct work upon completion of stimulus sheet at student's desk. Each letter is recorded as one correct or error response.	(Record: how long, by whom, how) Write Letters 1. app. size of letters 2. legible 3. letters must be touching lines as provided in each frame Error--other than above	(By whom Ratio or Interval) Date: _____	(Presentation criteria, i.e. who, what, how)

PLAN SHEET # ____ FOR: _____ TARGET A / M / D Pinpointed by: _____ Pupil / MANAGER / ADVISOR Date _____

LOCATION: _____ MANAGERS: _____, _____

PROGRAM	E ANTECEDENT	MOVEMENT CYCLE	ARRANGEMENT	E SUBSEQUENT
(Title plus details Time (s) and Dates)	(Presentation Criteria (who, what, how)	(Record: how long by whom, how)	(By whom. Ratio or Interval)	(Presentation criteria, i.e., who, what, how)
Distar Book A Date: _____ Time: _____ to _____ Group Instruction Reading	a. Teacher will begin when students are quietly seated at study table. Teacher will provide verbal stimulus and children will make individual or group verbal responses. b. Teacher will count correct and error responses on counter. She will time each response beginning immediately after providing stimuli. Stimuli will be individually directed questions.	Say Sounds Correct as determined by stimulus sheet. Error--other than above	Date: _____ 1:1 One error is equal to loss of one chip One correct is equal to one chip One shaping chip equals one point	


d
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PLAN SHEET # _____ FOR: _____ TARGET A[ ] M[ ] D[ ] Pinpointed by: _____ Pupil [ ] MANAGER [ ] ADVISOR [ ] Date _____

LOCATION: _____ MANAGERS: _____, _____

PROGRAM	E ANTECEDENT	MOVEMENT CYCLE	ARRANGEMENT	E SUBSEQUENT
(Title Plus details Time (s) and Dates) Distar Reading Date: _____ Time: _____ to _____	(Presentation Criteria, i.e. who, what how) Teacher presents stimulus Sheet. Student points to each letter and says sound for stimulus letter. Teacher takes 1 minute sample using a stop watch and double bank counter. Correct and error is recorded by teacher on event sheet.	(Record: how long, by whom, how) Say sounds Correct--enunciation of sound for Error--other than above	(By whom Ratio or Interval)	(Presentation criteria, i.e. who, what how)

o	n	t	m	s	a	d	r	ē	sh	ī	h	u	l	w	g	i	c	th	f
v	ō	k	j	sh	w	l	g	u	h	ā	t	n	o	c	th	i	r	d	ē
f	s	a	m	a	n	t	ā	h	u	g	l	w	sh	ī	k	ō	v	m	a
s	ē	f	d	r	i	th	c	o	n	v	ō	k	ī	w	sh	l	g	u	h

1-4-70

m	a	s	d	r	f	i	ē	th	c	o	t	t	o	c	th	i	f	r	a
s	m	f	th	o	i	a	c	d	r	s	m	ē	f	a	c	r	m	c	o
ē	s	o	f	m	th	a	c	r	i	th	s	d	c	th	i	ē	c	m	a
t	d	i	c	a	r	m	th	f	ē	m	a	t	o	r	f	t	o	th	s

PLAN SHEET # ____ FOR: _____ TARGET A[ ] M[ ] D[ ] Pinpointed by: _____ Pupil [ ] MANAGER [ ] ADVISOR [ ] Date _____

LOCATION: _____ MANAGERS: _____, _____

PROGRAM	E ANTECEDENT	MOVEMENT CYCLE	ARRANGEMENT	E SUBSEQUENT
(Title plus details Time (s) and Dates) Distar Book A Date: _____ Time: _____ to: _____ Group Instruction <u>Reading</u>	(Presentation Criteria, i.e. who, what how) a. Teacher will begin when students are quietly seated at study table. Teacher will provide verbal stimulus and children will make individual or group verbal responses. b. Teacher will count correct and error responses on counter. She will time each response beginning immediately after providing stimuli. Stimuli will be individually directed questions.	(Record: how long, by whom, how) Say Sounds Correct as determined by stimulus sheet <u>Error</u>--other than above	(By whom Ratio or Interval) Date: _____ 1:1 One error is equal to loss of one chip. One correct is equal to one chip. One shaping chip equals one point.	(Presentation criteria, i.e. who, what, how)

Correct	Error	Correct	Error	Correct	Error	Correct	Error	Correct	Error	Notes
𝍸 𝍸 𝍸

PLAN Sheet # ____ FOR: _____ TARGET A [ ] Pinpointed by: _____ Pupil [ ] Date _____
M [ ] Manager [ ]
D [ ] Advisor [ ]

LOCATION: _____ MANAGERS: _____, _____

PROGRAM	PROGRAMMED EVENT	MOVEMENT CYCLE	ARRANGEMENT	ARRANGED EVENT
(Title plus details (Time(s) and dates)	(Presentation Criteria, i.e. who, what, how)	(Record: how long, by whom, how)	(By whom, ratio or interval)	(Presentation Criteria, i.e., who, what, how)
Basic Multiplication Facts (Say Numbers) One Minute Sample beginning March _____. Set I : 0, 1, 2 Set II : 3, 4, 5 Set III : 6, 7, 8 Set IV : 9, 10	Teacher presents multiplication sheet to student. Student will say answers only to as many problems as possible during one minute period.	Recorded for one minutes only by teacher using stop watch and counter. Correct: Appropriate number said in response to problem stimulus.	Period of non-reinforcement	Student is presented with new set of multiplication facts after correctly saying numbers for _____ consecutive days. (Student must also correctly write numbers on corresponding sheet for _____ consecutive days.)

MULTIPLICATION

NAME _____

DATE _____

7	5	8	8	9	4	7	8	9	7	7	2	3	1
×3	×1	×3	×6	×6	×2	×4	×7	×3	×5	×3	×0	×0	×0
9	7	5	5	8	4	9	8	8	6	9	7	6	5
×8	×3	×0	×2	×7	×3	×0	×3	×6	×2	×8	×4	×3	×4
9	4	5	9	6	9	9	8	6	7	9	3	8	9
×0	×2	×3	×7	×0	×4	×7	×0	×2	×1	×4	×0	×3	×5
9	7	9	4	8	7	6	9	4	2	7	9	9	4
×0	×3	×5	×0	×2	×4	×0	×8	×3	×0	×6	×4	×2	×3
7	8	9	6	7	8	7	8	4	9	2	7	9	8
×6	×5	×0	×3	×4	×2	×0	×5	×1	×3	×0	×4	×6	×7
8	9	3	9	6	8	5	9	6	5	3	7	9	9
×4	×7	×2	×5	×4	×7	×3	×6	×2	×4	×2	×1	×4	×8
5	7	3	9	4	6	8	9	6	5	7	4	9	4
×3	×0	×2	×6	×1	×2	×0	×1	×4	×0	×2	×3	×8	×2

MULTIPLICATION NAME _____

DATE _____

5	7	9	2	8	9	5	6	7	9	5	8	7	6
×2	×5	×3	×1	×7	×3	×4	×0	×6	×2	×0	×4	×3	×2
8	6	8	6	7	7	3	8	9	5	8	3	9	8
×0	×3	×0	×4	×0	×7	×2	×0	×4	×1	×7	×2	×0	×3
7	4	9	5	7	6	7	6	3	9	4	3	6	5
×6	×3	×4	×0	×1	×2	×5	×4	×1	×8	×0	×2	×0	×9
4	7	9	2	5	9	2	4	5	3	2	7	4	8
×8	×9	×3	×9	×6	×6	×8	×7	×9	×8	×9	×5	×9	×3
5	3	2	6	9	2	6	9	4	2	7	3	8	4
×7	×9	×8	×9	×4	×8	×8	×6	×5	×9	×4	×9	×2	×7
3	5	8	6	7	8	3	7	7	9	7	5	7	3
×8	×6	×9	×4	×4	×7	×9	×5	×3	×8	×5	×8	×4	×9
8	6	6	8	7	3	8	4	4	5	6	4	7	6
×3	×8	×9	×4	×6	×9	×5	×9	×7	×9	×9	×9	×8	×7

MULTIPLICATION NAME _____

DATE _____

9	7	0	6	4	9	7	8	0	2	6	7	4	3
x0	x0	x6	x2	x0	x0	x2	x0	x6	x6	x3	x0	x3	x0
0	3	5	5	6	4	9	4	0	3	2	6	0	1
x3	x5	x0	x4	x3	x3	x0	x1	x3	x2	x6	x0	x1	x3
3	3	7	6	1	4	3	1	0	2	5	2	6	1
x3	x5	x2	x1	x8	x3	x1	x0	x2	x7	x3	x6	x1	x0
0	4	7	9	4	2	7	6	2	8	0	0	5	6
x0	x4	x1	x0	x3	x2	x2	x1	x3	x1	x9	x4	x1	x2
5	6	2	6	3	0	8	6	3	4	6	7	1	3
x0	x0	x2	x1	x2	x2	x1	x0	x3	x5	x0	x2	x3	x5
6	0	0	1	1	2	0	3	0	2	1	2	3	1
x0	x0	x1	x0	x1	x0	x2	x0	x3	x1	x2	x2	x1	x3
4	0	0	5	1	4	2	3	6	0	1	5	2	4
x0	x4	x5	x0	x4	x1	x3	x2	x0	x6	x5	x1	x4	x2
3	0	7	1	6	2	5	3	4	8	0	1	7	2
x3	x7	x0	x6	x1	x5	x2	x4	x3	x0	x8	x7	x1	x6

MULTIPLICATION NAME_____

DATE_____

5	0	4	8	7	9	3	2	5	6	4	8	7	3
x1	x3	x3	x1	x2	x0	x5	x5	x4	x3	x3	x0	x2	x5
5	6	9	6	2	4	5	3	2	7	5	4	8	3
x2	x2	x0	x2	x4	x5	x3	x2	x7	x0	x4	x3	x0	x5
5	7	0	3	2	6	9	4	2	6	0	6	4	5
x3	x0	x3	x2	x6	x2	x0	x2	x6	x0	x8	x0	x5	x0
0	2	7	4	3	2	4	7	3	0	5	8	3	6
x2	x7	x2	x3	x2	x4	x3	x0	x0	x5	x3	x0	x6	x0
8	0	6	4	7	4	3	3	7	5	3	2	0	0
x0	x9	x2	x2	x2	x3	x0	x5	x2	x2	x2	x0	x3	x0
0	8	3	0	5	2	4	0	3	6	8	6	2	0
x9	x0	x5	x5	x2	x7	x3	x8	x6	x2	x0	x3	x4	x4
9	8	4	7	6	3	8	5	4	0	2	4	3	5
x0	x1	x3	x0	x3	x5	x0	x4	x0	x2	x3	x3	x5	x0
6	3	5	4	0	9	1	8	2	7	3	6	4	5
x2	x5	x3	x4	x9	x0	x8	x1	x7	x2	x6	x3	x5	x4

APPENDIX C

SAMPLE GRAPHS--STUDENT PERFORMANCE

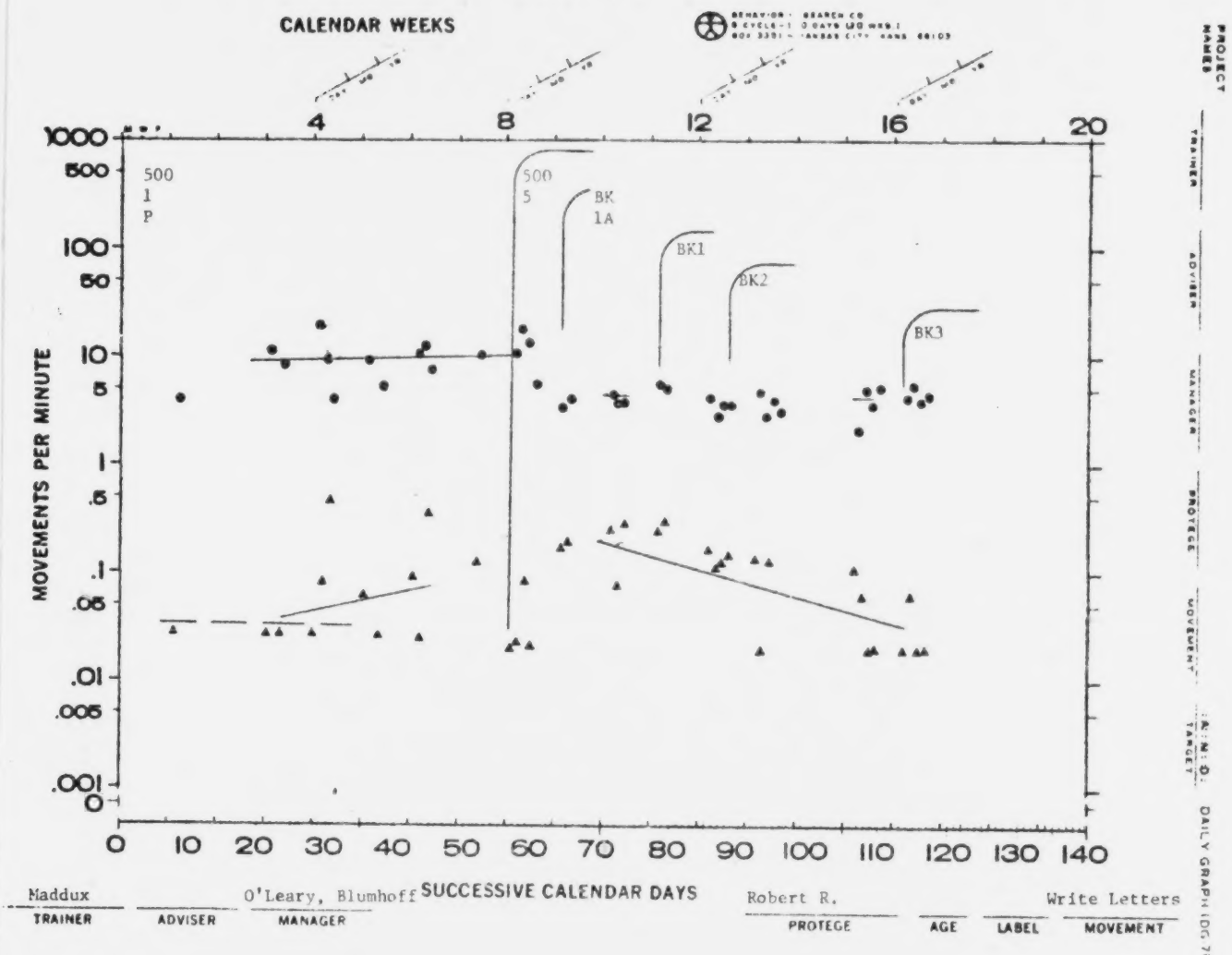
EXPERIMENTAL CONDITION: A

PLAN SHEET # 2 FOR: _____ TARGET A☐ M☐ D☐ Pinpointed by: _____ Pupil ☐ MANAGER ☐ ADVISOR ☐ Date _____

LOCATION: _____ MANAGERS: _____, _____

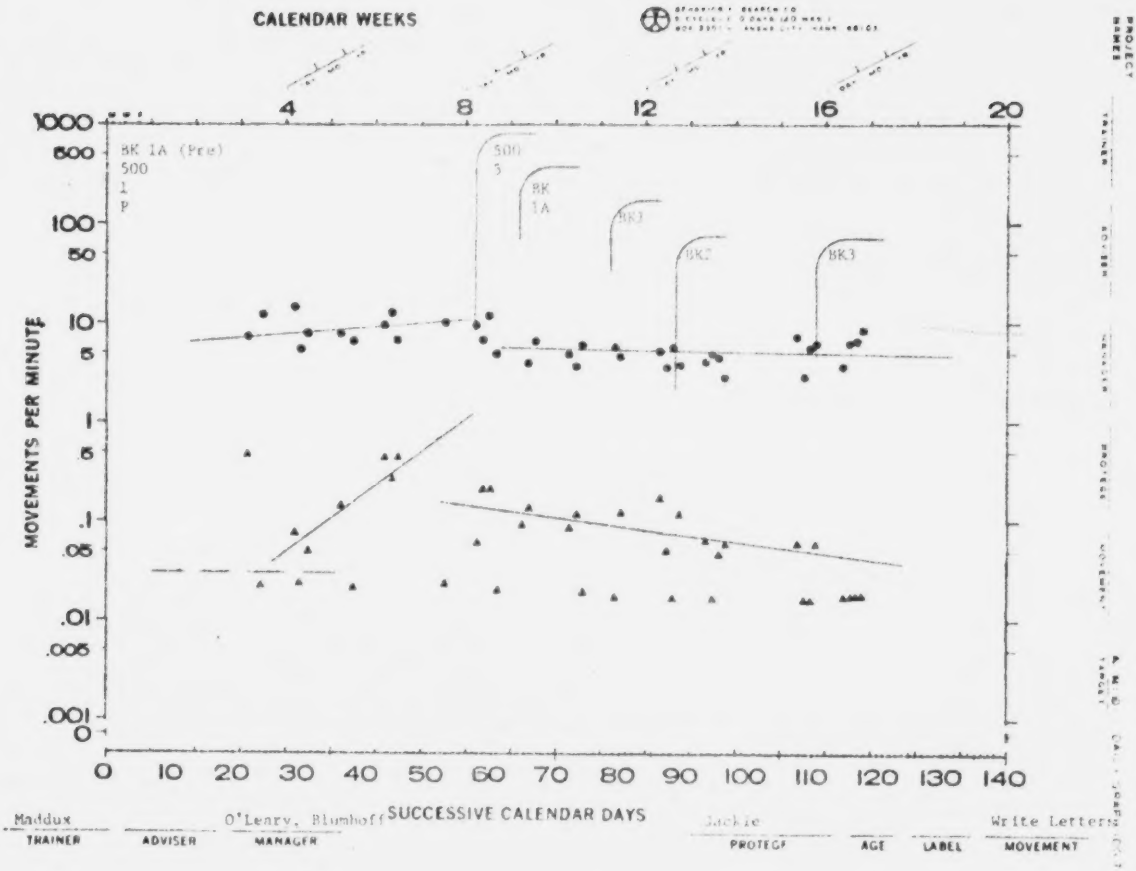
PROGRAM	E ANTECEDENT	MOVEMENT CYCLE	ARRANGEMENT	E SUBSEQUENT
(Title plus details Time (s) and Dates) Programmed Reading - Sullivan and Assoc., Webster Division, McGraw Hill Book Company. Book level _____. Daily from _____ to _____; beginning _____, ____, 1970.	(Presentation Criteria, i.e. who, what how) The teacher presents the book to the child on the first day of the program. She dates the page on which the child begins. (After the first day, the child gets his book from his desk, dates the page, and begins working.) The teacher says, "Do ___ answers and raise your hand to call the teacher. Raise your hand when you see the hand drawn in your book." (every ____responses are pre-counted by the teacher. Each ___ responses are marked by a hand drawn on the page.) The teacher will only go to the child after he has completed the required number of responses.	(Record: how long, by whom, how) M. C.=write letter Recorded (for ____ minutes between ____ and ____ by the teacher on the event sheet. Correct=appropriate letter written in response to the question stimulus presented by the book. Error=opposite of above.	(By whom Ratio or Interval) Experimental Condition: A. Period of non-reinforcement. _____ number of pupil responses = the following subsequent.	(Presentation criteria, i.e. who, what, how) After a set number of responses completed by the pupil, the teacher comes to the pupil and corrects his work with him. The teacher says, "Correct your errors, then raise your hand, to call me."

GRAPH 17-1



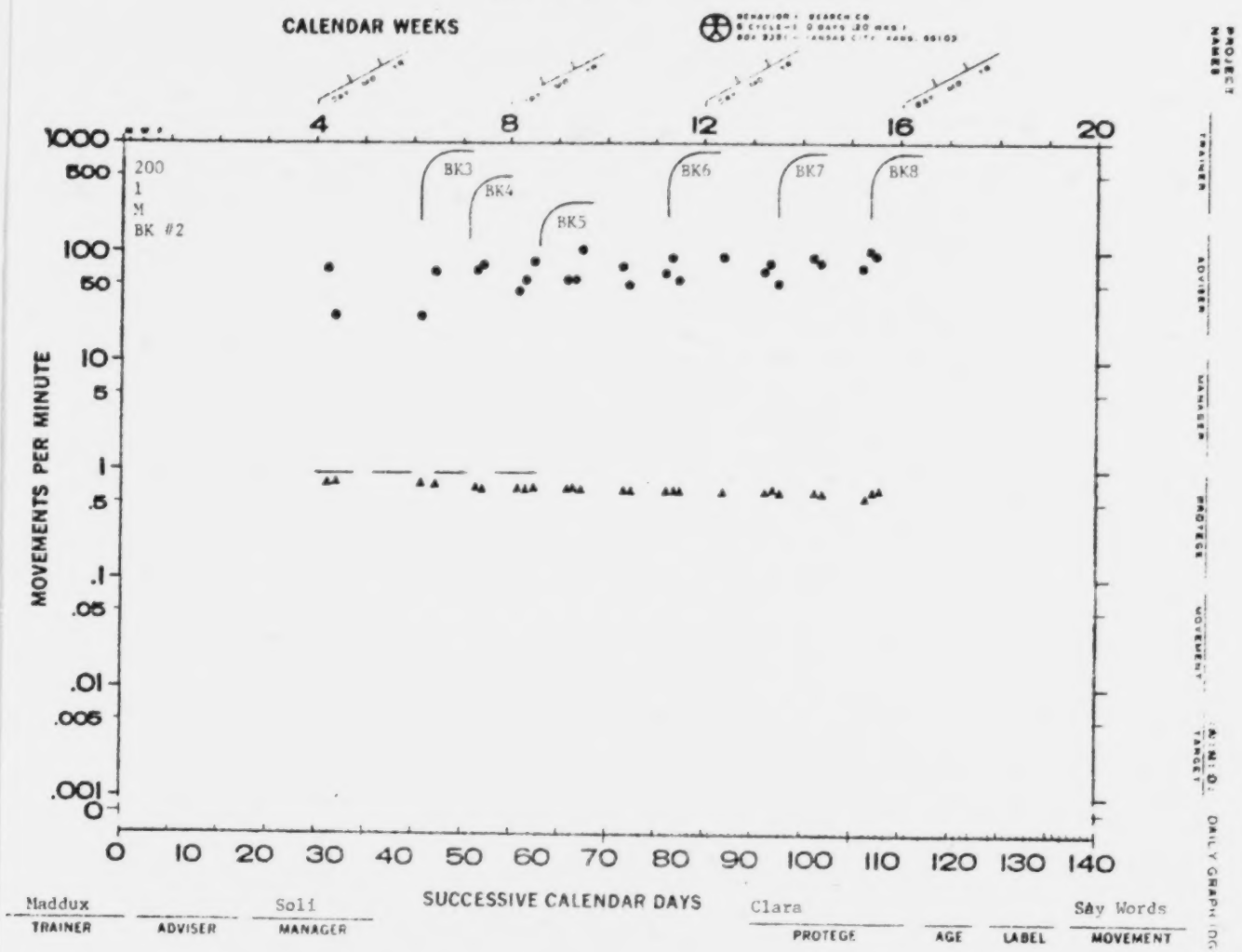
Graphs 17-1 and 12-1 (Sullivan) Are examples of situation in which an increase error response trend is reversed by lowering the teacher contact code. More frequent teacher contacts not only allows for additional teaching, but also tends to curtail student guessing and carelessness.

GRAPH 12-1



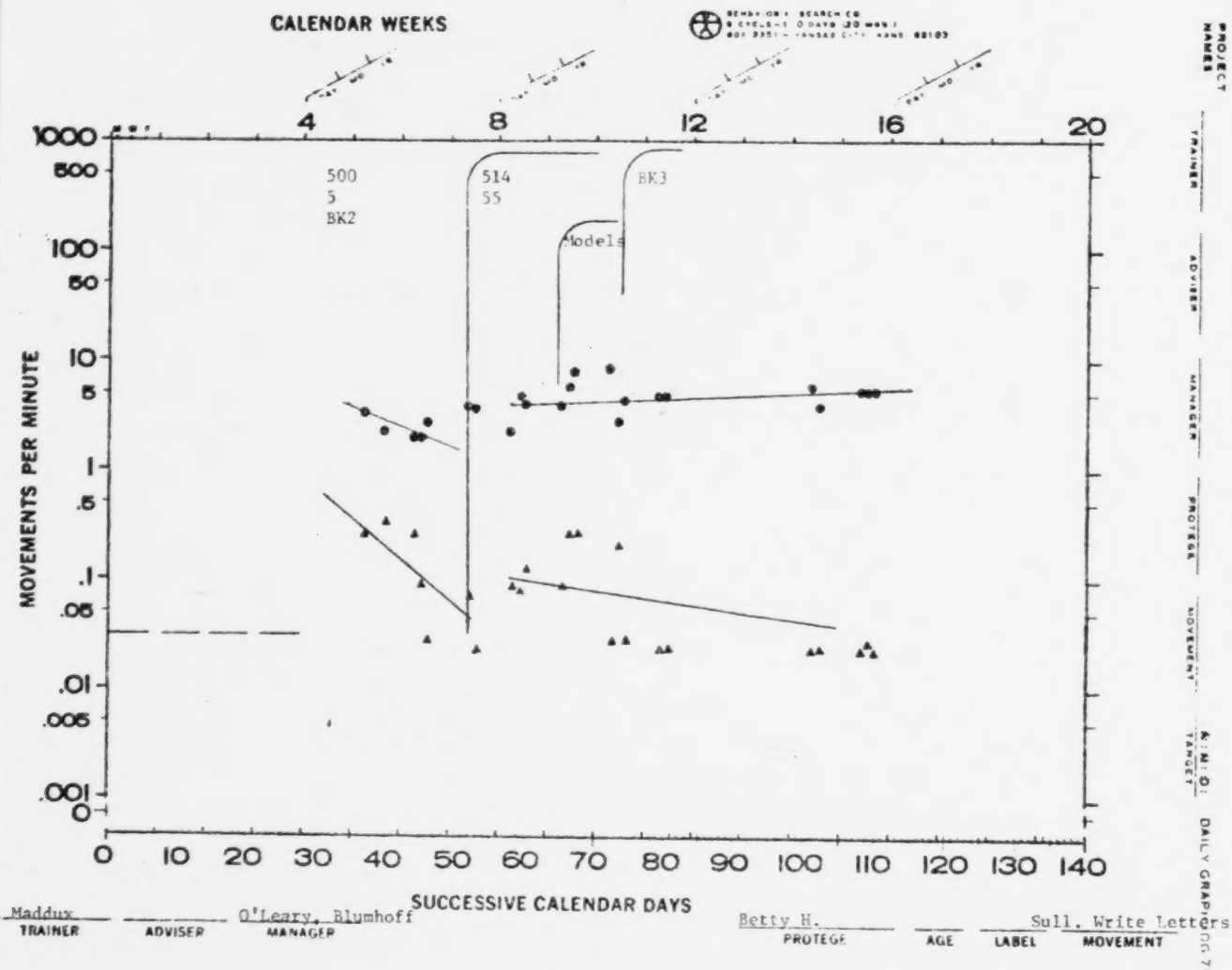
Graphs 17-1 and 12-1 (Sullivan) Are examples of situation in which an increasing error response trend is reversed by lowering the teacher contact code. More frequent teacher contacts not only allows for additional teaching, but also tends to curtail student guessing and carelessness.

GRAPH 05-14



Graph 05-14 Is a students Sullivan Programmed Reading one-minute Say Word graph. When a teacher makes decisions concerning the students Write Letter response rates, he should first consult this graph so that he can determine the students ability to read (sight-word recognition) the material.

GRAPH 19-2



Graph 19-2 (Sullivan) illustrates the implementation of a contingency arrangement in a reading program of points and models (reinforcement). Again, the result is an increase in positive responses with an accompanying error response decrease.

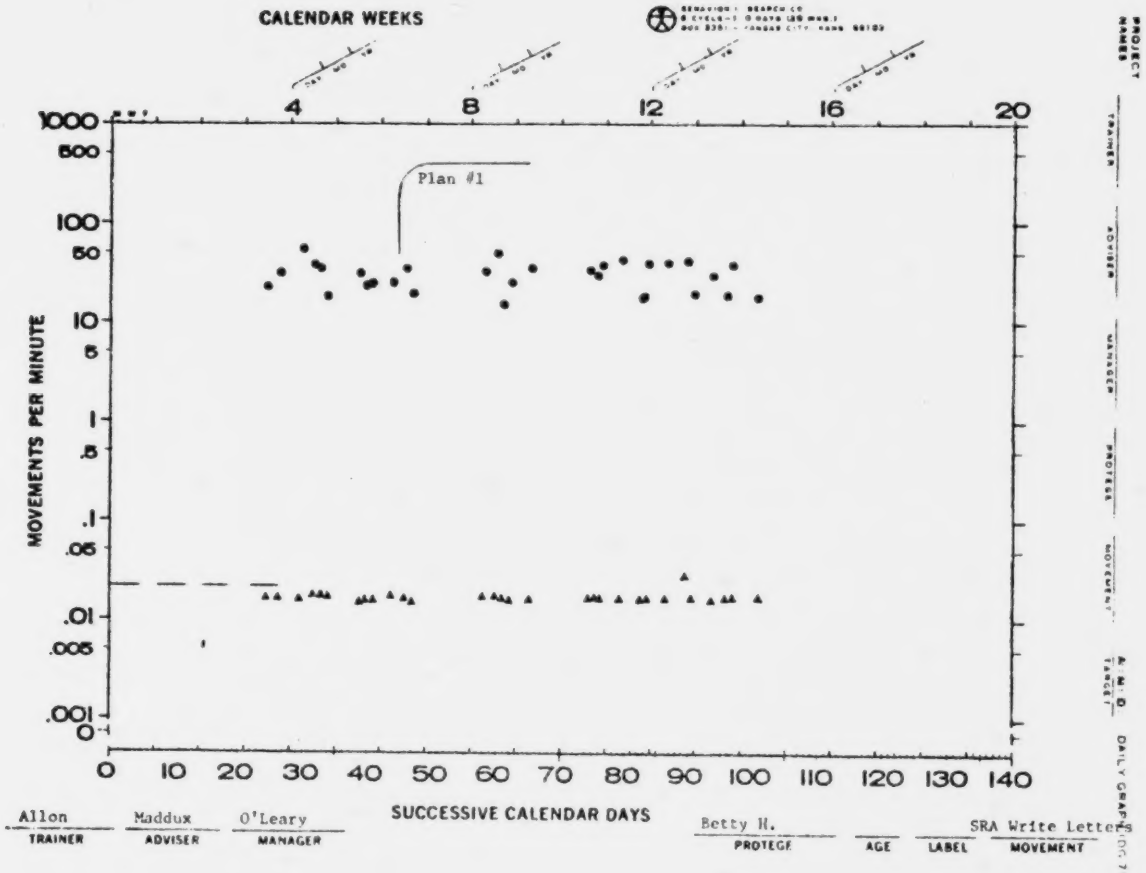
Typical Plan Sheet for SRA
Reading Readiness

PLAN SHEET # 1 FOR: Betty H. TARGET A ☒ M ☐ D ☐ Pinpointed by: _____ Pupil ☐ MANAGER ☒ ADVISOR ☒ Date 2-25-70

LOCATION: Lister School MANAGERS: _____, _____

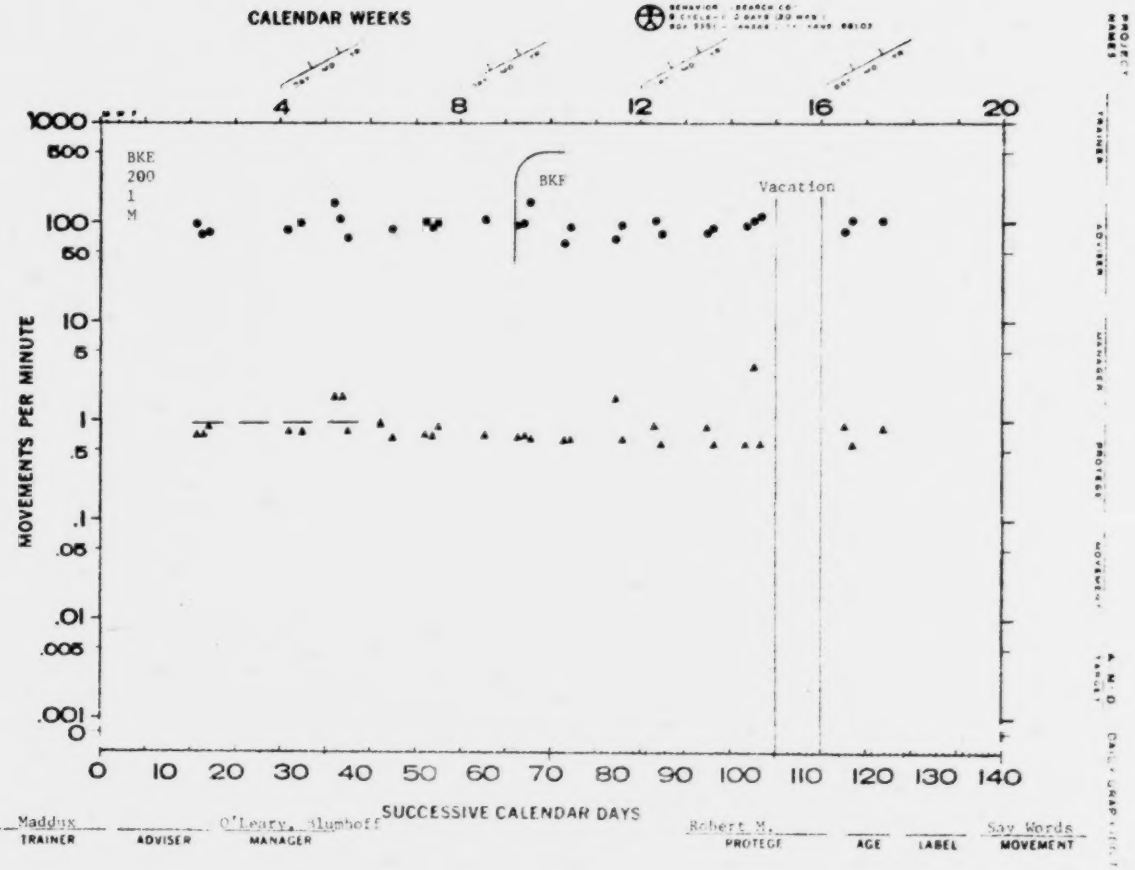
PROGRAM	E ANTECEDENT	MOVEMENT CYCLE	ARRANGEMENT	E SUBSEQUENT
(Title plus details Time (s) and Dates)	(Presentation Criteria, i.e. who, what how)	(Record: how long, by whom, how)	(By whom Ratio or Interval)	(Presentation criteria, i.e. who, what, how)
SRA Readiness Program Date - Feb. 25, 1970 Time - 10:50-11:30 Letters a, n, t, p 3-18-70 added Added d	Teacher presents material to pupil. Pupil writes one page and calls the teacher. Pupil calls teacher by raising hand and sitting quietly.	Write letters Correct: letters of approximate size and structure in comparison to stimulus letters Error: letters of a different size or shape than stimulus letters	Teacher checks work and student corrects errors before going to next page.	

GRAPH 19-29



Graphs 19-29 and 21-5 (SRA Reading Lab 1A) Illustrate that a student who is working in the individualized environment of the precision teaching program will (if properly placed, and managed) gravitate to a pattern of errorless responses.

GRAPH 21-15



Graphs 19-29 and 21-15 (SRA Reading Lab IA) Illustrate that a student who is working in the individualized environment of the precision teaching program will (if properly placed, and managed) gravitate to a pattern of errorless responses.

Typical Plan Sheet for
Suppes Math

Graph # 101

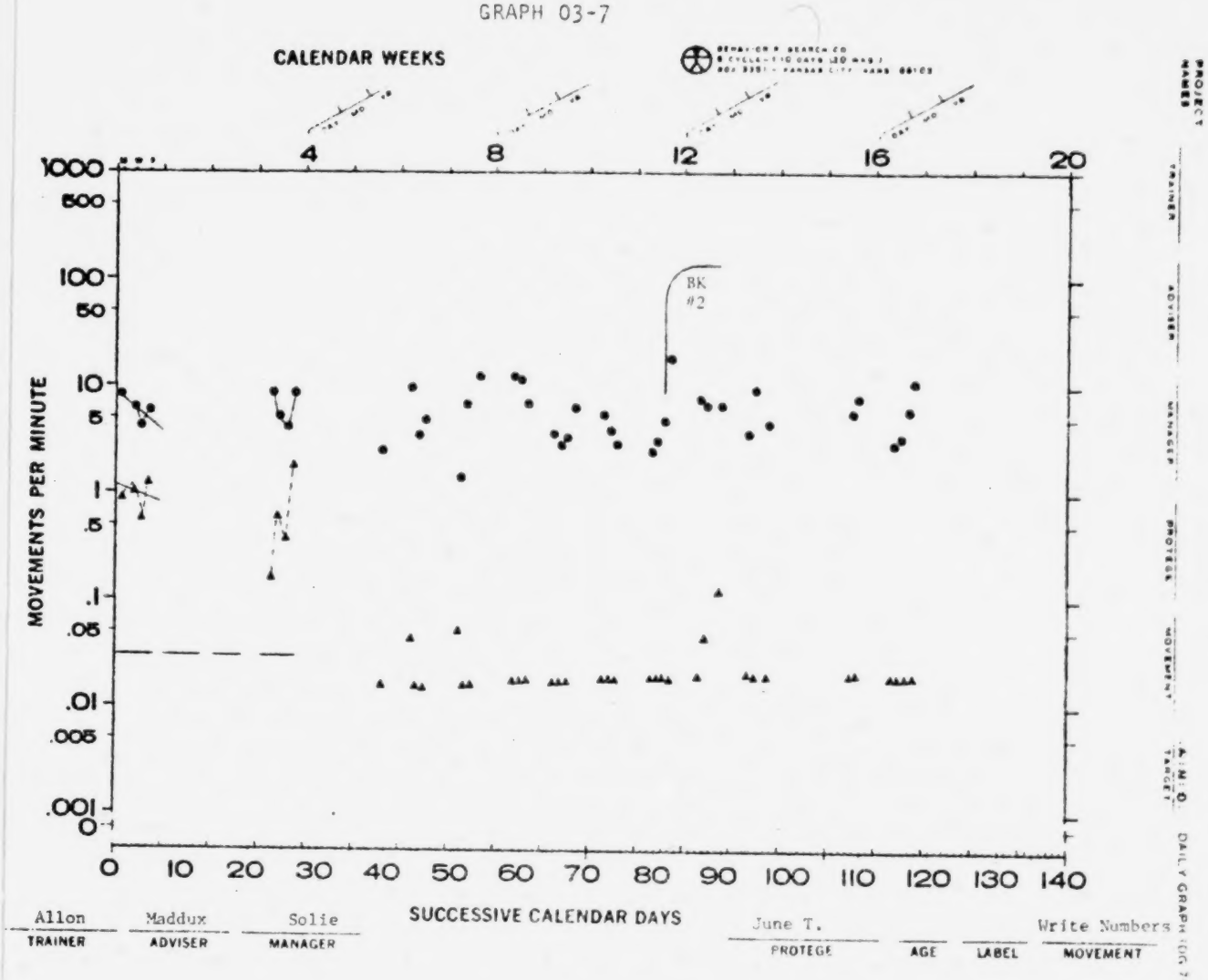
EXPERIMENTAL CONDITION A

PLAN SHEET # ___ FOR: JUANITA TARGET A[✓] M[ ] D[ ] Pinpointed by: _____ Pupil [ ] MANAGER [ ] ADVISOR [ ] Date 1-28-70

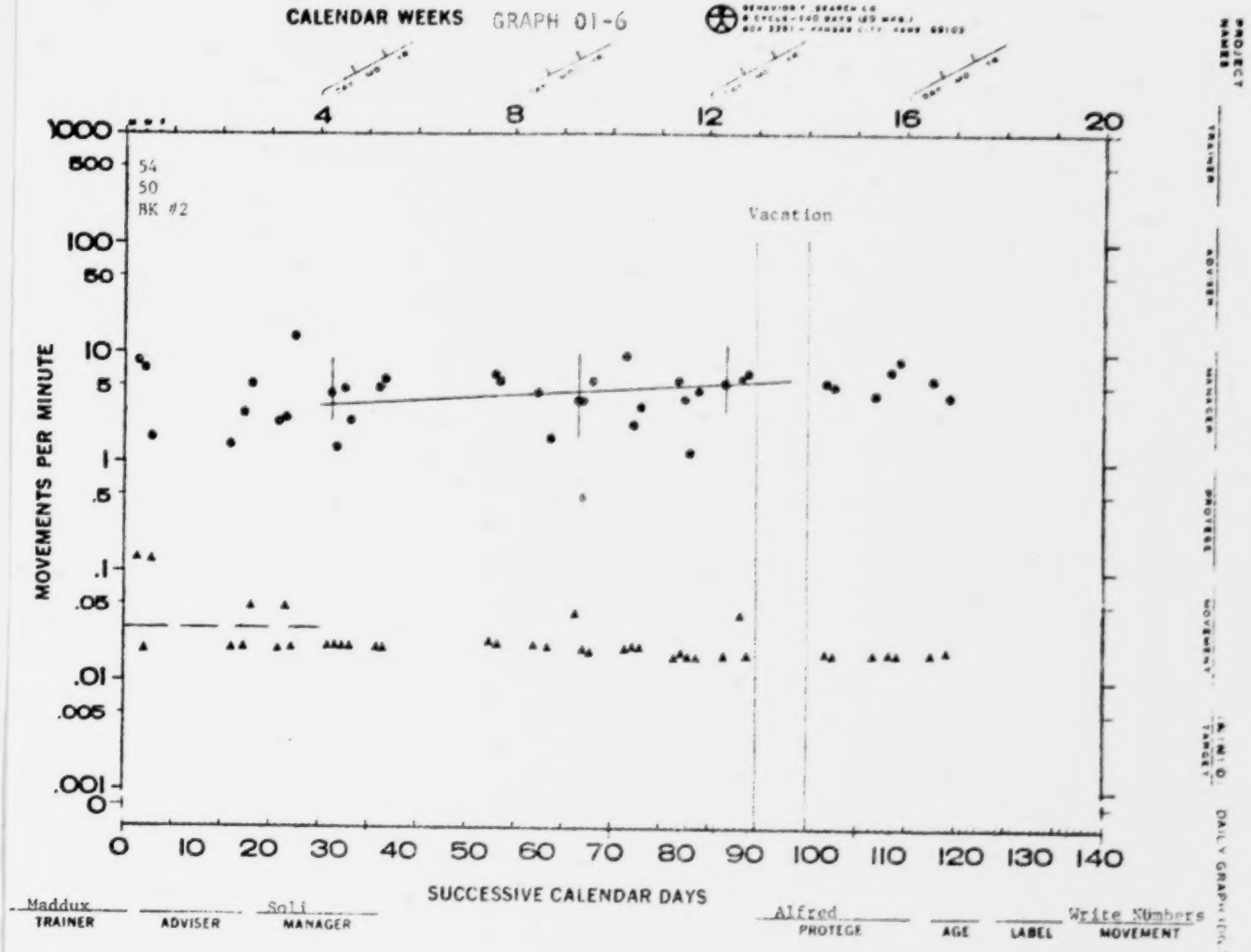
LOCATION: LISTER SCHOOL MANAGERS: ALLON, MADDUX, O'LEARY

PROGRAM	E ANTECEDENT	MOVEMENT CYCLE	ARRANGEMENT	E SUBSEQUENT
(Title plus details Time(s) and Dates) Sets and Numbers (Rev. ed.), Patrick Suppes and Joanne Suppes. Book level K. Daily from 10:00 to 10:30; beginning 1, 28, 1970.	(Presentation Criteria, i.e. who, what how) The teacher presents the book to the child on the first day of the program. She dates the page on which the child begins. (after the 1st day, the child gets his book from his desk, dates the page, and begins working.) The teacher stays with the child until he makes the first three responses. She helps him with any errors he makes by teaching the sequence required by the response. The teacher then says, "Work until you see the hand- then call me." (Every 5 responses are precounted). The teacher allows pupil initiated contacts to occur.	(Record: how long, by whom, how) M.C.= write numbers Recorded for 30 minutes between 10:00 and 10:30 by the teacher on the event sheet. Correct = appropriate number written in response to the stimulus problem presented. Error = opposite of above.	(By whom Ratio or Interval) 5 pupil write number responses equal the following subsequent. 3-4-70 Teacher determined fixed ratio schedule 5:1 for correct responses. Responses must be correct the first time to receive points.	(Presentation criteria, i.e., who what, how) The teacher comes to the child and corrects his work with him. The teacher teaches the frames where error responses occur. She then says, "Correct your errors, then raise your hand to call me." 3-4-70 Child decides how points will be used. Recess - 20 pts. 1 pt = 1 min. of ft 4/16/70 Recess= 10 pts.

GRAPH 03-7

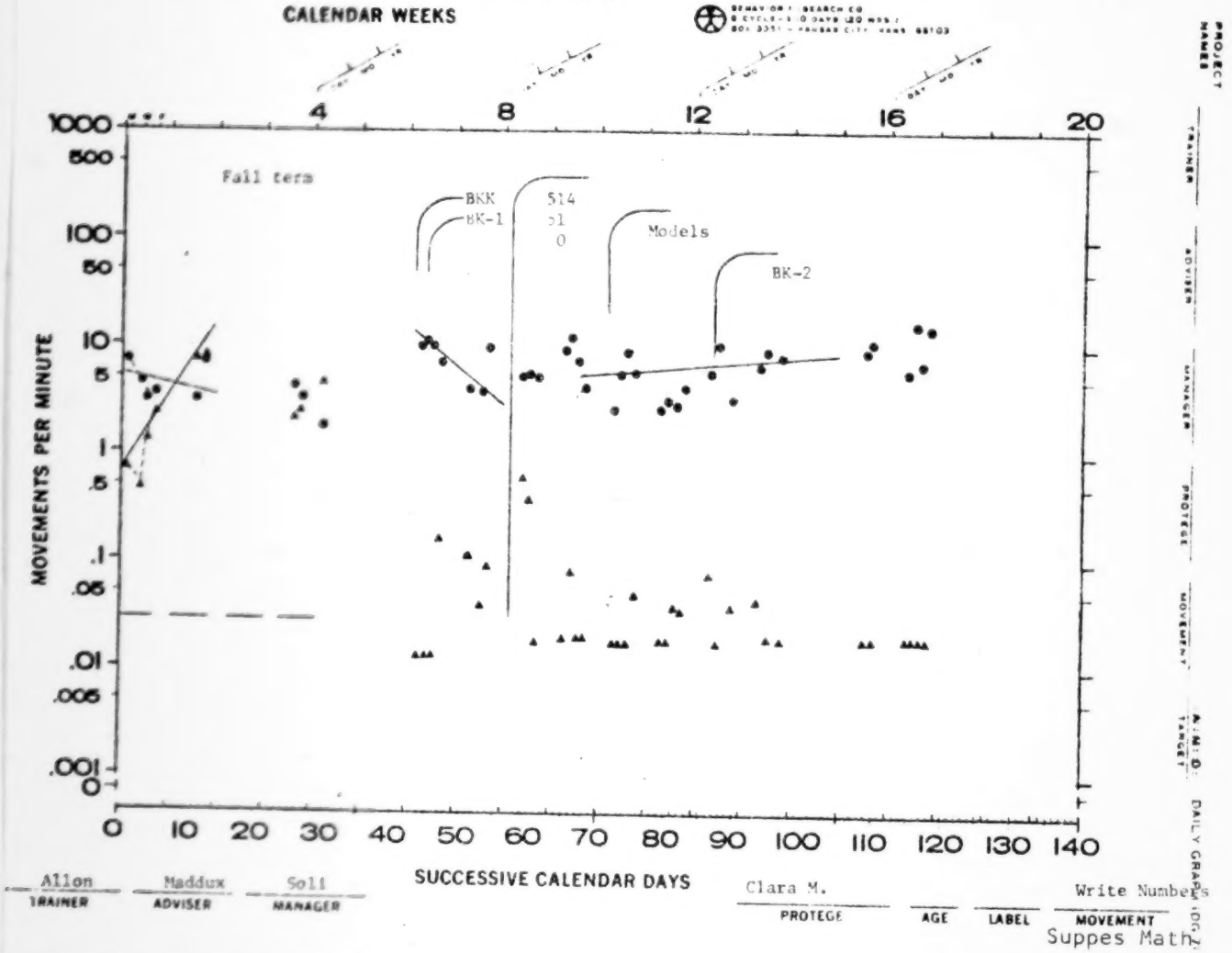


Graphs 01-6, and 03-7 Suppes Math illustrate two students who worked for a long period of time without an extrinsic reinforcement system in effect. The day to day fluctuation in correct rate is probably more a function of inconsistentcy in material difficulty than student motivation.



Graphs 01-6, and 03-7 Suppes Math illustrate two students who worked for a long period of time without an extrinsic reinforcement system in effect. The day to day fluctuation in correct rate is probably more a function of inconsistentcy in material difficulty than student motivation.

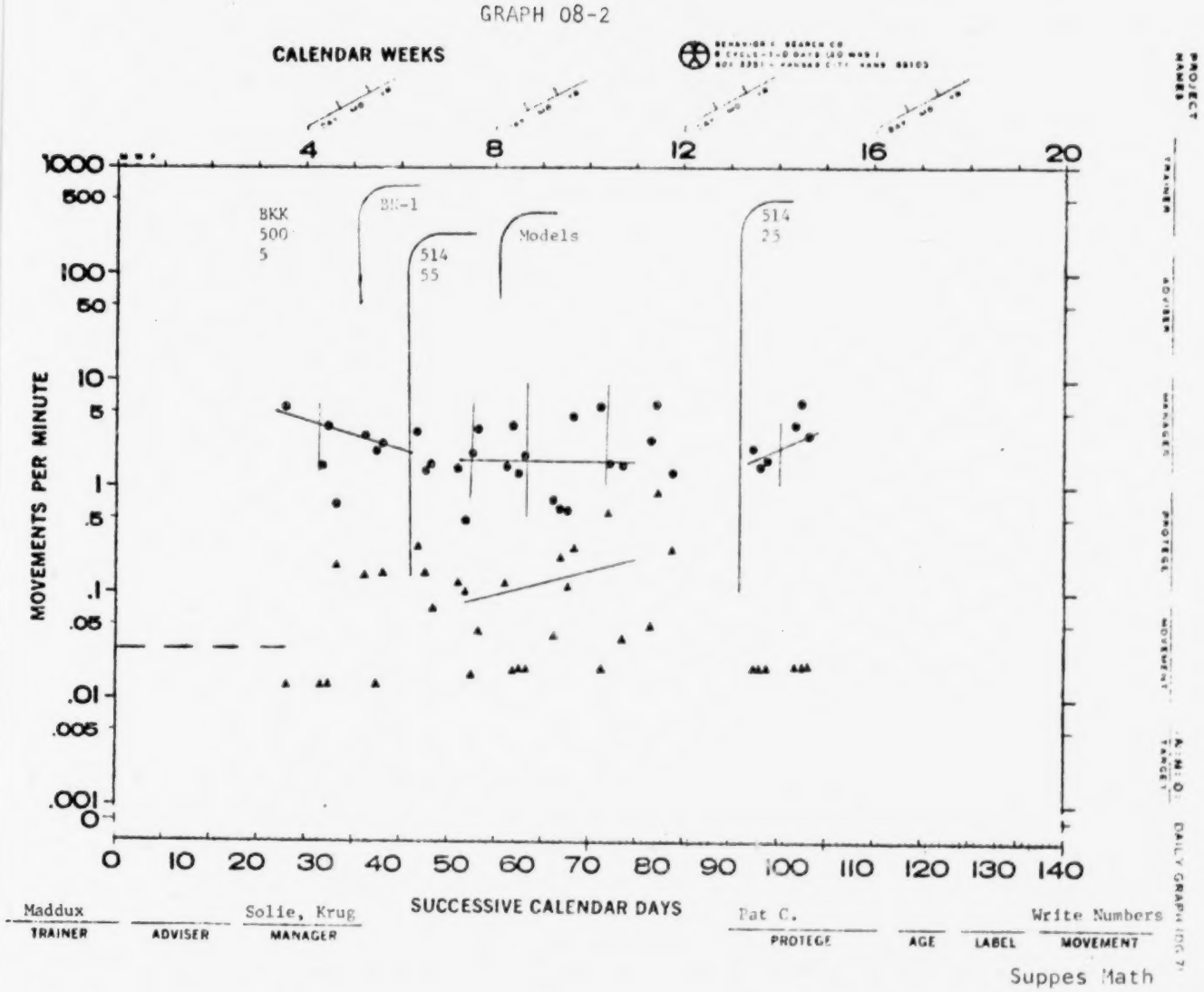
GRAPH 05-7



Graph 05-7 is a representative example of the resulting effects of a contingency instituded phase change. On 10-12-70, following a 2 week trend of rising errors and falling corrects, the student was put on points. For the next two weeks the students corrects stabilized, and the errors began to approach zero.

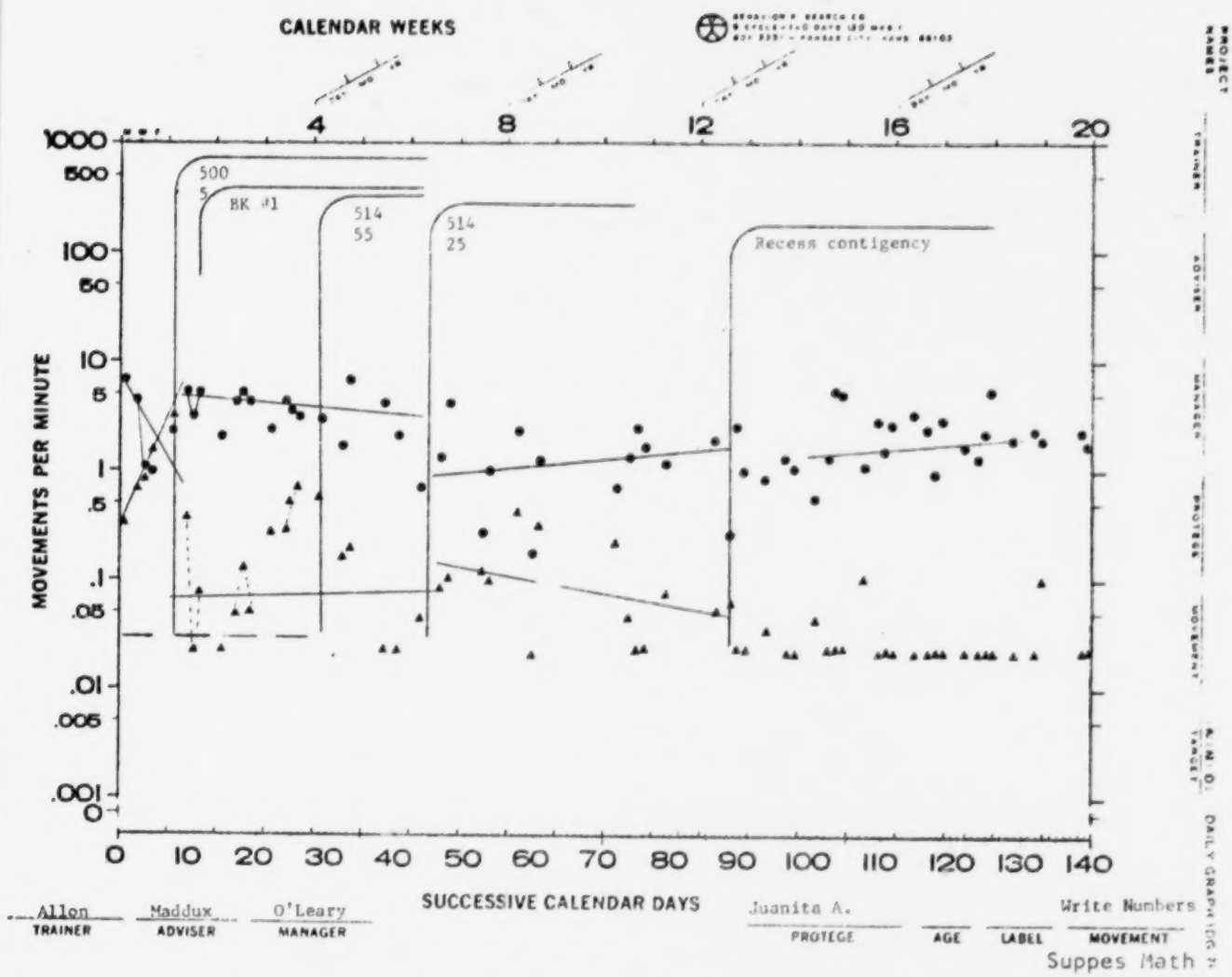
On 10-26-70 the student was allowed the opportunity to buy models. Placement of this added contingency (called an "Add On") resulted in a steady increase in correct responses and a decrease in error responses to the zero level. It is noteworthy to observe that these trends occured concurrent with an increase in material difficulty (placement in book 2 on 11-10-70).

GRAPH 08-2



Graph 08-2 Depicts a situation in which a reinforcement contingency did not effect correct and error rates. In such a situation one of two possibilities is occurring. Either the reinforcement is not a reinforcement to that child, or the material is too difficult. Usually if the student is making responses then it is a material problem, and more teaching must take place. On 11-30-70 the teacher contact code was changing from every five problems to every two problems. The next two weeks show a resulting decrease in errors to zero and a steady increase in correct responses.

GRAPH 14-3



Graph 14-3 Illustrates a situation in which a teacher code change on 3-4-/0 did not subsequently significantly effect correct and error rates which had also been resistant to a positive reinforcement contingency. Therefore, on 4/15/70 a negative contingency was instituted. Beginning on that date recess would cost 20 points. If the student didn't earn enough points to buy recess then she would have to work on math during the recess period. As a result of this contingency the student's error responses fluctuated around zero and her correct responses show a positive trend.

DATA SHEET # 1 FOR: Julie H TARGET A[4] Appointed by: ____ Pupil [ ] Date 9-21-70
B[ ] MANAGER [4]
C[ ] ADVISOR [ ]

LOCATION: Lister School MANAGERS: Maddux, O'Leary, Blumhoff

PROGRAM	E ANTECEDENT	MOVEMENT CYCLE	ARRANGEMENT	E SUBSEQUENT
(Title plus details Item (s) and Dates)	(Presentation Criteria, i.e. who, what how)	(Records how long, by when, how)	(By when Ratio or Interval)	(Presentation criteria, i.e. who, what, how)
Oral Reading Date: 9-23-70 Time: 11 [00] to 11 [30]	Teacher presents stimulus sheet. Student points to each letter and says its name. Teacher times 1 minute sample using a stop watch and double tank counter. Correct and error is recorded by teacher on event sheet.	Say letters Correctness of letter for each stimulus letter Error--other than above.		

DATA SHEET # ____ FOR: _____ TARGET A[ ] B[ ] C[ ] Prog. taken by: _____ Pupil [ ] MANAGER [ ] ADVISOR [ ] Date _____

LOCATION: _____ MANAGERS: _____, _____

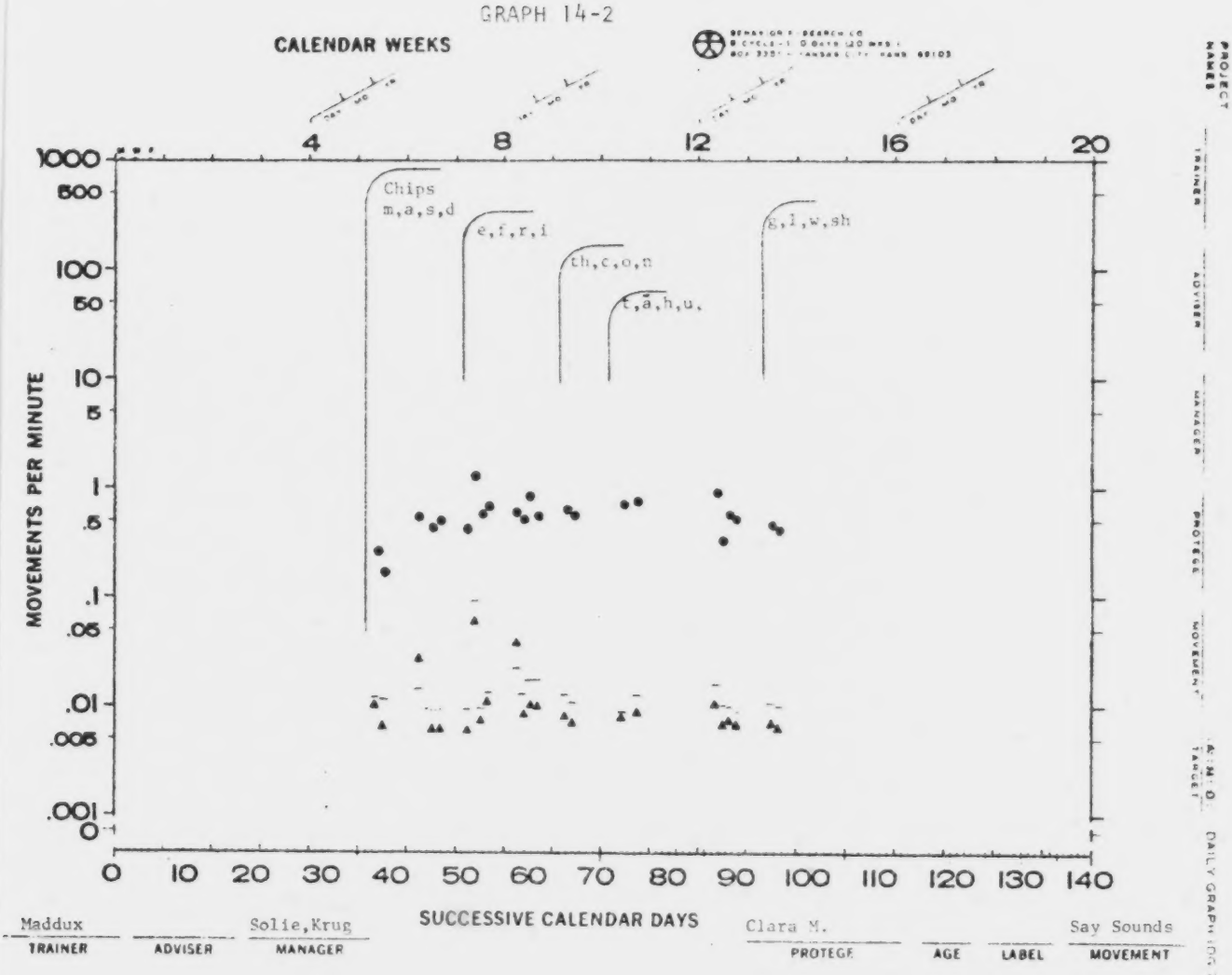
PROGRAM	E ANTECEDENT	MOVEMENT CYCLE	ARRANGEMENT	E SUBSEQUENT
(Title plus details (Time (s) and Dates)	(Presentation Criteria, i.e. who, what how)	(Record: how long, by whom, how)	(By whom Ratio or Interval)	(Presentation criteria, i.e. who, what, how)
Distar Reading Date: _____ Time: _____ to _____	Teacher presents stimulus sheet. Student points to each letter and says sound for stimulus letter. Teacher takes 1 minute sample using a stop watch and double bank counter. Correct and error is recorded by teacher on event sheet.	Say sounds Correct--enunciation of sound for stimulus letter Error--other than above		

PROJECT #____ FOR: _____ Checked by: _____ Supt ☐ Date 9-23-70

LOCATION: Lister PARTIES: Maddux, O'Leary, Blumhoff

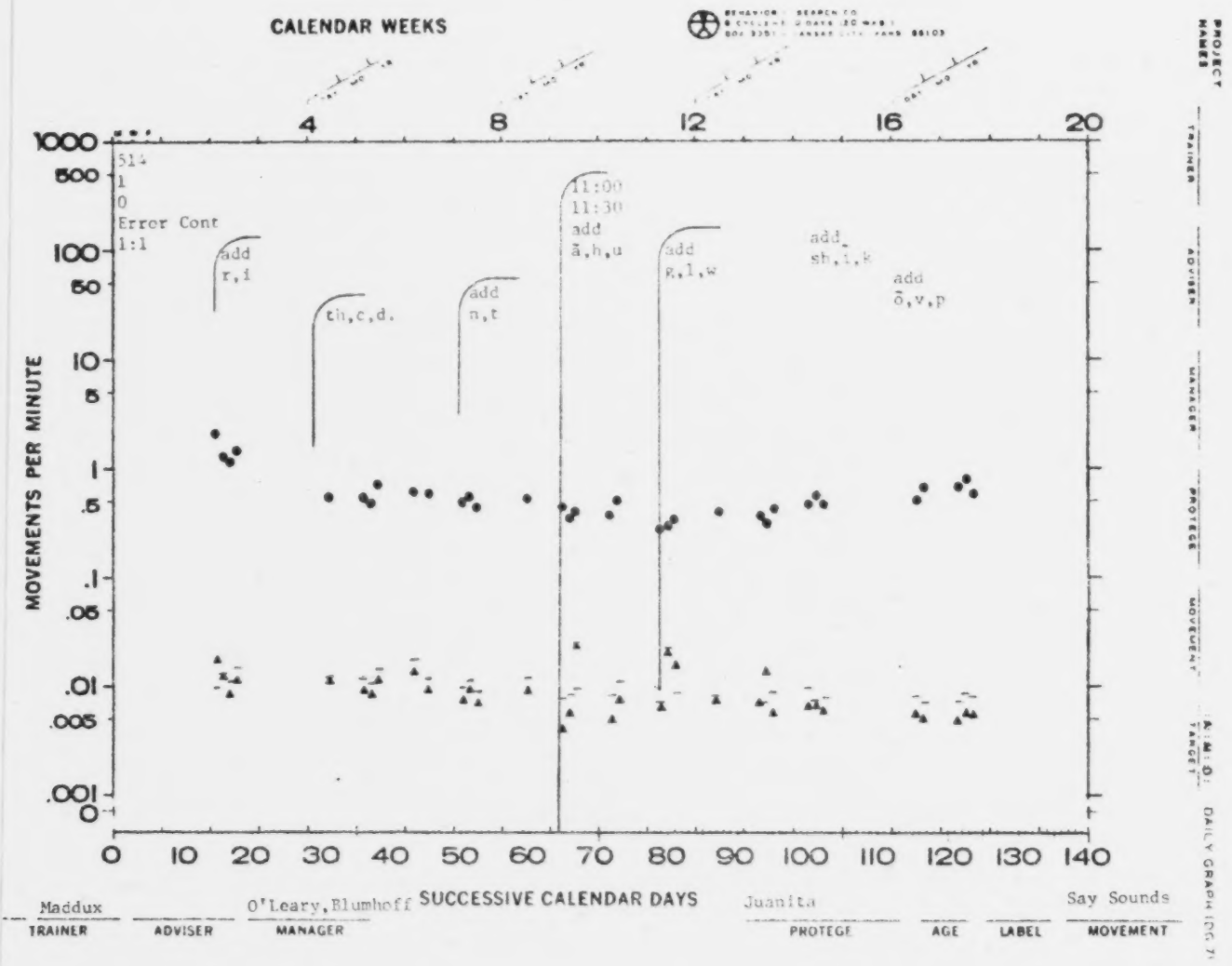
PROGRAM	E ASSESSMENT	MONITORING CYCLE	ADJUSTMENT	E SUBSEQUENT
(Title plus details Type (s) and Rates)	(Presentation Criteria, i.e. who, what how)	(Records-how long by whom, how)	(By when Ratio or Interval)	(Presentation criteria, i.e. who, what, how)
Visual Reading Date: Sept. 23 Time: 1:30 P.M. to 2:00 P.M. Write Letters	Teacher provides situation sheets. Student will write responses as indicated in situation boxes. Student will raise hand after completion of each page. Work is corrected by teacher at student's desk. Each letter is recorded as one correct or error response and recorded by teacher.	Write letters Correct-of approximate size as stated and legible. Error--other than above	E	

GRAPH 14-2



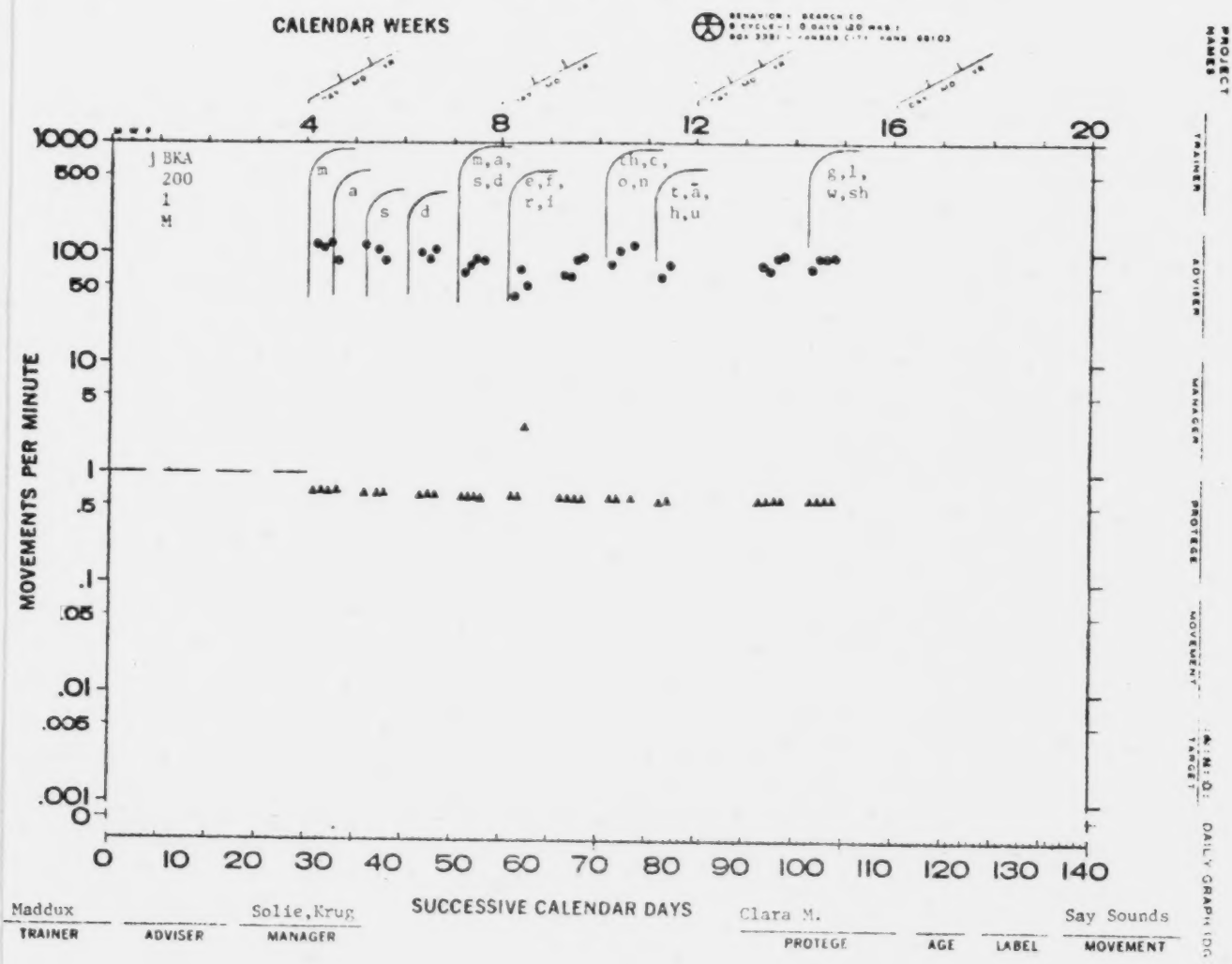
Graphs 14-1 through 14-7 illustrate typical student performance in DISTAR Group say-sounds, say letter, individual say-sounds, and write letters. Group say-sounds has the "floating floor" whereas the other three measurements were one-minute samples.

GRAPH 14-1



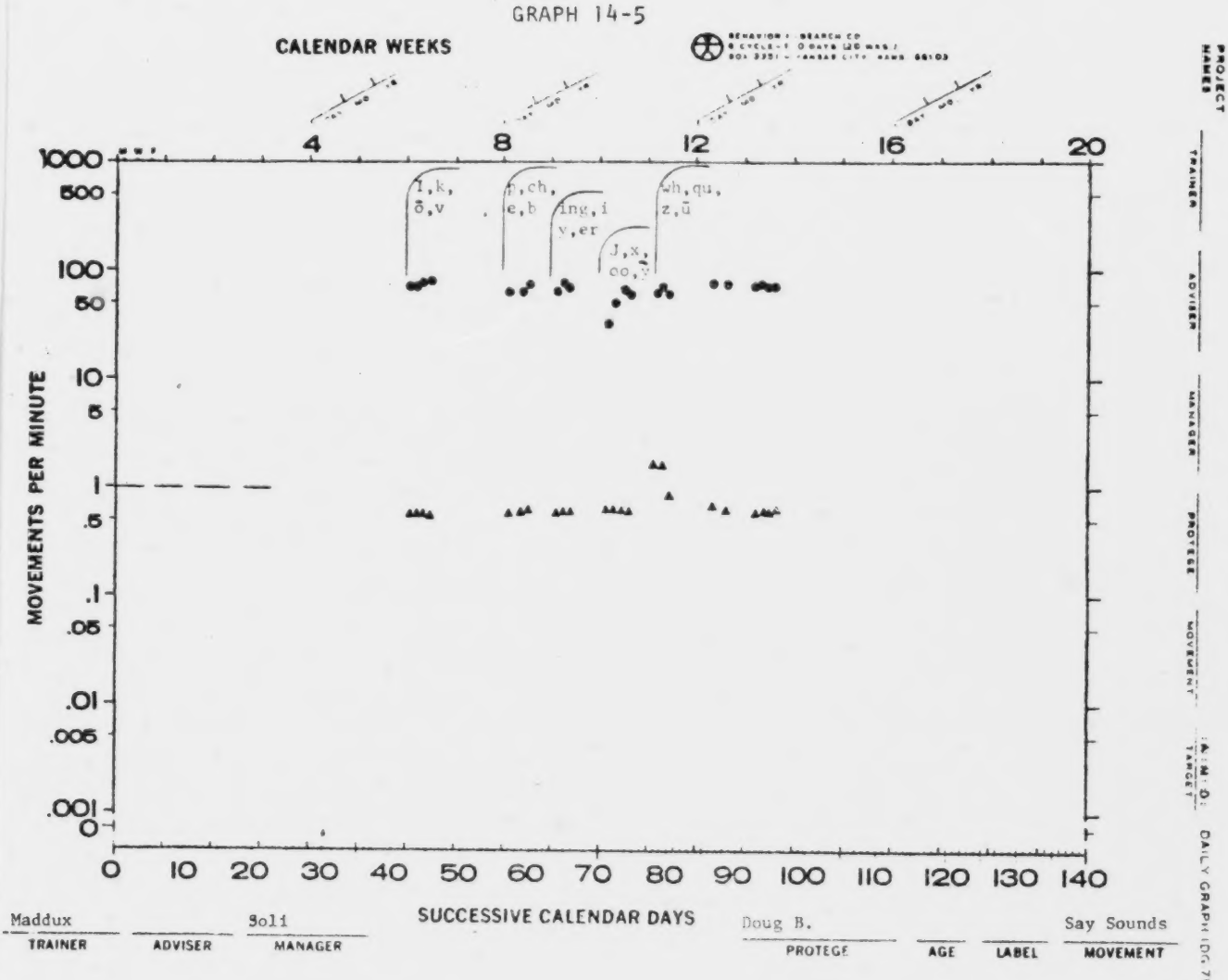
Graphs 14-1 through 14-7 illustrate typical student performance in DISTAR Group say-sounds, say letter, individual say-sounds, and write letters. Group say-sounds has the "floating floor" whereas the other three measurements were one-minute samples.

GRAPH 14-4



Graphs 14-1 through 14-7 illustrate typical student performance in DISTAR Group say-sounds, say letter, individual say-sounds, and write letters. Group say-sounds has the "floating floor" whereas the other three measurements were one-minute samples.

GRAPH 14-5



Maddux — TRAINER

— ADVISER

Soli — MANAGER

Doug B. — PROTEGE

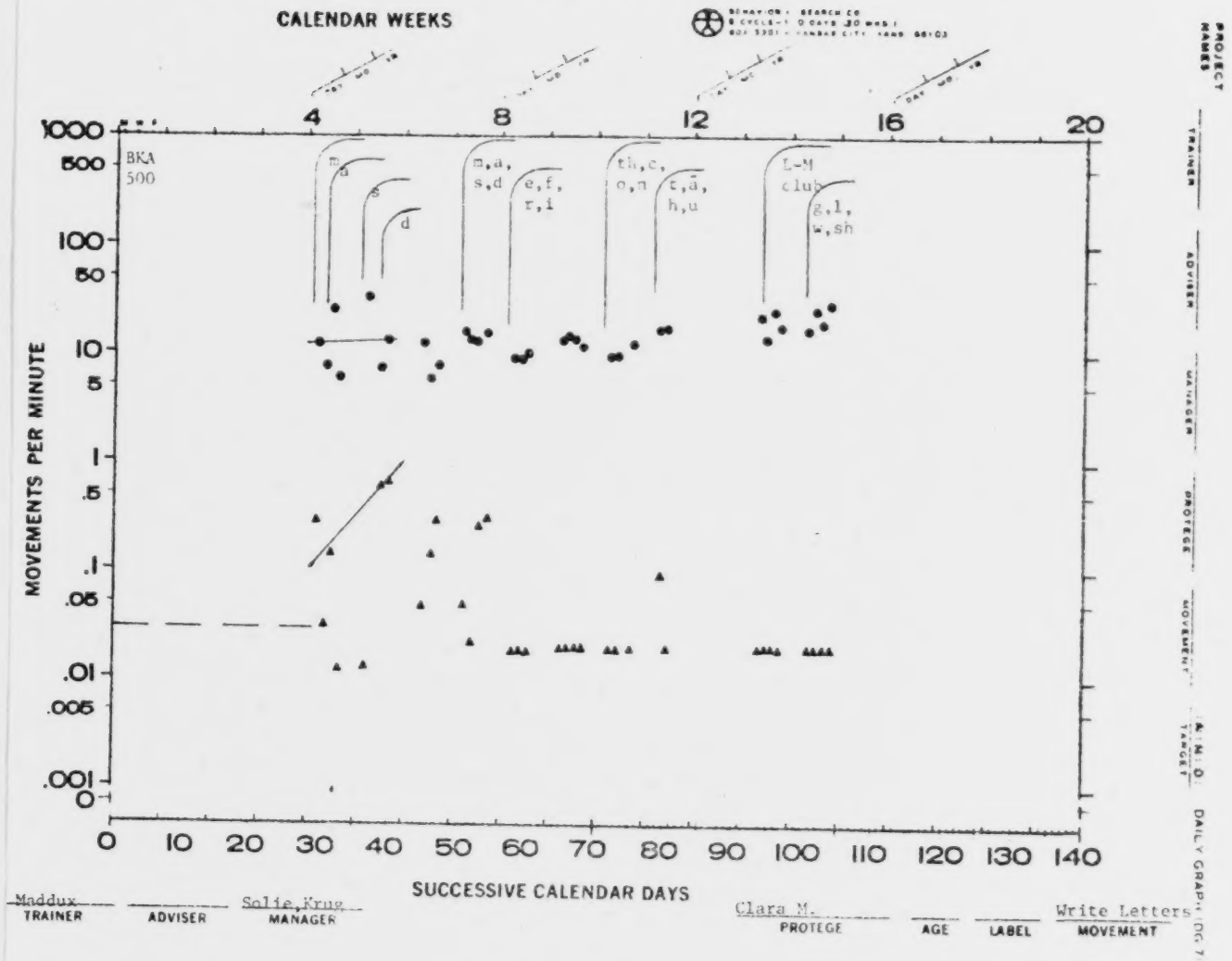
— AGE

— LABEL

Say Sounds — MOVEMENT

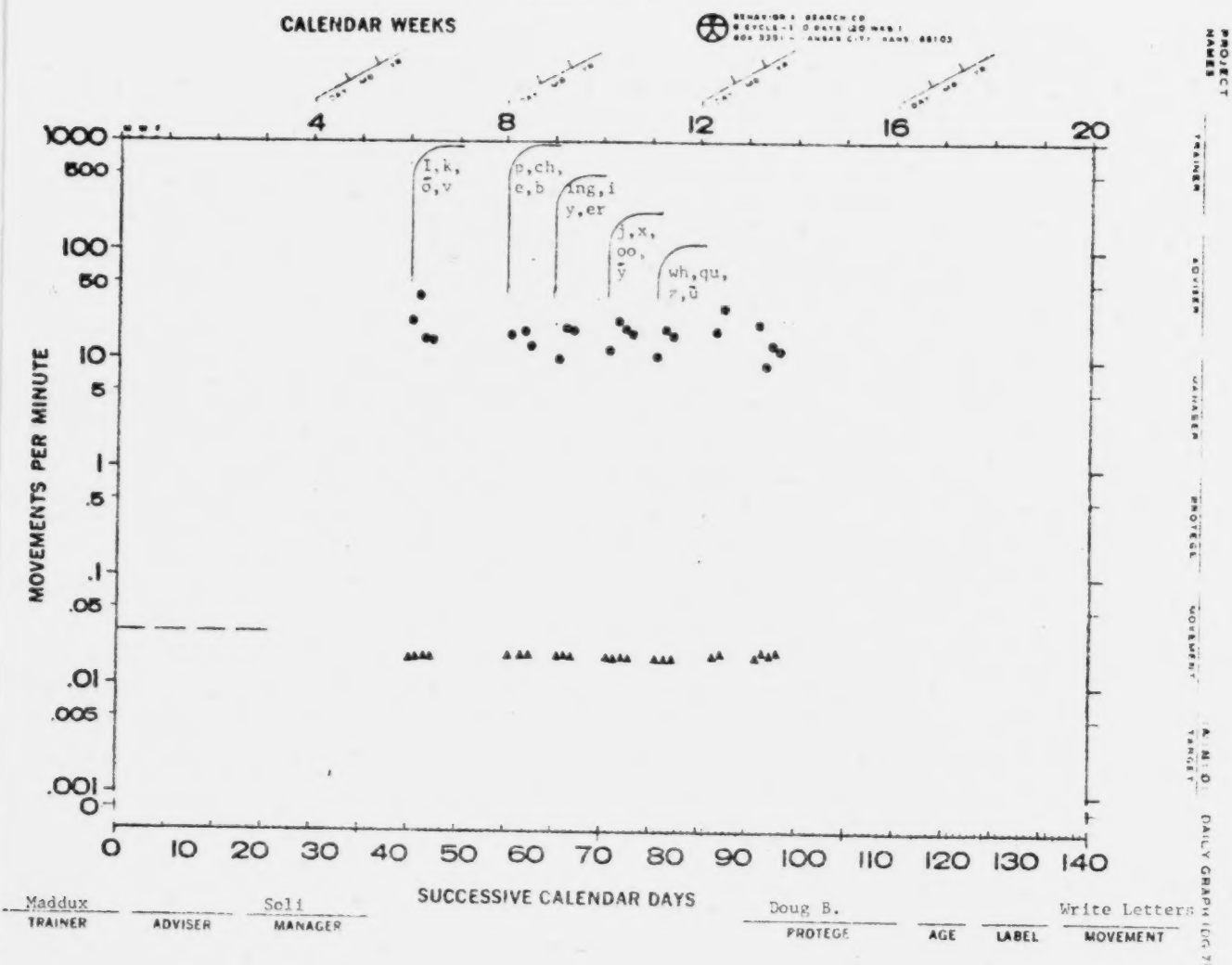
Graphs 14-1 through 14-7 illustrate typical student performance in DISTAR Group say-sounds, say letter, individual say-sounds, and write letters. Group say-sounds has the "floating floor" whereas the other three measurements were one-minute samples.

GRAPH 14-6



Graphs 14-1 through 14-7 illustrate typical student performance in DISTAR Group say-sounds, say letter, individual say-sounds, and write letters. Group say-sounds has the "floating floor" whereas the other three measurements were one-minute samples.

GRAPH 14-7



Graphs 14-1 through 14-7 illustrate typical student performance in DISTAR Group say-sounds, say letter, individual say-sounds, and write letters. Group say-sounds has the "floating floor" whereas the other three measurements were one-minute samples.

APPENDIX D

COMPUTER SUMMARIES BY VARIABLE

SUMMARY BY VARIABLE

VARIABLE	Sullivan Pre-Probes		Sullivan Post-Probes		Sullivan Pre-Probes		Sullivan Post-Probes	
	Alfred B. correct rate	error rate	Alfred B. correct rate	error rate	Ron S. correct rate	error rate	Ron S. correct rate	error ra
DAYS	4		2		9		3	
MEAN	2.5	5.1	9.0	3.7	1.7	1.13	8.1	.6
ST. DEV.	1.4	5.0	5.6	1.0	1.1	1.15	2.4	.2
MEDIAN	2.3	5.0	9.0	3.7	1.2	.40	7.0	.7
MIN.	1.1	.7	5.0	3.0	.6	0	6.5	.4
MAX.	4.5	10.00	13.0	4.5	3.5	3.00	11.0	.8
	June T.		June T.		Arv el M.		Arvel M.	
DAYS	4		3	.3	4		3	
MEAN	6.1	1.0	10.5	.4	2.4	3.57	7.0	3.7
ST. DEV.	1.4	.29	4.7	.3	1.2	3.66	3.0	2.2
MEDIAN	6.1	1.0	11.0	0	2.7	1.70	7.0	3.5
MIN.	6.1	.6	5.5	.8	.6	.4	4.0	1.6
MAX.	8.0	1.3	15.0		3.5	0.5	10.0	6.0
	Robert M.		Robert M.		Clarence F.		Clarence F.	
DAYS	4		2		4		3	
MEAN	4.7	3.76	13.7	.05	4.3	4.12	11.3	1.6
ST. DEV.	1.8	3.76	3.8	.1	1.5	4.03	3.2	2.0
MEDIAN	4.0	2.15	13.7	.5	3.9	4.0	10.0	.5
MIN.	3.0	.50	11.0	.4	3.0	.80	9.0	.4
MAX.	4.5	9.0	16.5	.6	6.5	10.0	15.0	4.0

SUMMARY BY VARIABLE

VARIABLE	Juanita A. correct rate	Juanita A. error rate	Juanita A. correct rate	Juanita A. error rate	Gary W. correct rate	Gary W. error rate	Gary W. correct rate	Gary W. error rate
DAYS	5		5		5		2	
MEAN	3.3	.86	5.3	.86	4.6	2.92	14.0	.5
ST. DEV.	2.5	.68	.9	.68	1.7	2.52	4.2	.4
MEDIAN	2.5	.80	5.5	.80	4.0	2.9	14.0	.5
MIN.	1.1	0	4.0	0	2.7	.5	11.0	.2
MAX.	7.0	1.90	6.5	.9	6.5	7.0	17.0	.8
	Coe N.		Coe N.		Jackie S.		Jackie S.	
DAYS	4		4		5		5	
MEAN	3.6	4.05	5.3	.65	6.0	4.72	8.9	1.6
ST. DEV.	.73	3.15	1.5	.23	4.1	2.72	7.1	1.4
MEDIAN	3.9	3.7	5.0	.75	5.1	3.5	6.0	1.7
MIN.	2.5	.8	4.0	.30	.8	2.1	3.0	.2
MAX.	4.0	8.0	7.5	.80	11.5	8.0	21.0	3.9
	Julie W.		Julie W.		Bobbie R.		Bobbie R.	
DAYS	5		6		5		4	
MEAN	3.5	2.5	6.0	2.5	4.2	1.7	6.8	1.7
ST. DEV.	1.6	1.7	5.0	1.7	2.6	.82	2.8	.8
MEDIAN	2.7	2.7	4.9	2.7	5.5	1.60	5.7	1.6
MIN.	2.2	.60	1.4	.6	.2	1.0	4.8	1.0
MAX.	6.2	5.3	13.5	5.3	6.5	2.8	11.0	2.8

SUMMARY BY VARIABLE

VARIABLE	Robert D. correct rate	Robert D. error rate	Robert D. correct rate	Robert D. error rate	Patrick C. correct rate	Patrick C. error rate	Patrick C. correct rate	Patrick C. error ra
DAYS	7		3		5		2	
MEAN	2.0	2.29	6.2	2.7	2.3	3.92	6.0	6.2
ST. DEV.	1.2	3.30	3.3	1.0	1.0	3.98	.77	8.1
MEDIAN	1.7	2.30	5.0	2.1	2.2	3.2	6.0	6.2
MIN.	.7	.40	3.6	2.1	1.1	.1	5.5	.5
MAX.	4.0	10.0	10.0	4.0	3.5	9.0	6.5	12.0
	Doug B.		Doug B.		Betty H.		Betty H.	
DAYS	4		2		5		1	
MEAN	4.8	5.3	12.5	.9	7.0	1.2	30.0	1.2
ST. DEV.	.77	7.14	6.3	.5	3.7	0	0	0
MEDIAN	4.5	1.95	12.5	.9	7.5	1.2	30.0	1.2
MIN.	4.3	1.3	8.0	.5	3.0	1.2	30.0	1.2
MAX.	6.0	6.0	17.0	1.3	12.0	1.2	30.0	1.2
	Julie H.		Julie H.		Robert M.		Robert M.	
DAYS	5		5		5		2	
MEAN	2.8	.32	4.1	.3	7.6	.25	12.5	.25
ST. DEV.	1.5	.14	2.1	.1	1.5	.21	4.9	.21
MEDIAN	.7	.10	2.4	.1	5.5	.10	4.0	.1
MIN.	5.0	.50	7.5	.5	9.0	.40	16.0	.4
MAX.								

SUMMARY BY VARIABLE

Sullivan Book 1A, AM

VARIABLE	Alfred B.		Ron S.		June T.		Clarence F.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error
DAYS	4		3		16		6	
MEAN	4.6	.025	3.4	.1	4.5	.72	4.6	.16
ST. DEV.	2.0	.050	.5	.1	1.1	.77	1.0	.31
MEDIAN	4.0	0	3.5	.1	4.5	.6	4.2	.05
MIN.	3.0	0	2.9	0	2.7	0	3.7	0
MAX.	7.5	.1	3.9	.2	6.5	2.0	6.5	.8
	Robert D.		Coe N.		Jackie S.		Bobbie R.	
DAYS	15		6		7		5	
MEAN	3.9	.22	2.2	0	6.6	.18	4.5	.26
ST. DEV.	1.3	.40	.3	0	2.3	.14	1.0	.18
MEDIAN	3.8	0	2.3	0	7.3	.20	4.5	.20
MIN.	1.8	0	1.9	0	3.0	0	3.0	.10
MAX.	6.5	1.2	2.6	0	8.6	.40	5.5	.50
	Robert B.		Robert M.		Gregg E.		Class Average	
DAYS	5		14		8			
MEAN	4.5	.04	8.4	.09	8.3	.65	4.7	.36
ST. DEV.	.84	.05	3.5	.13	2.5	.30	1.3	.46
MEDIAN	4.5	0	6.5	0	8.0	.70	5.0	.11
MIN.	3.9	0	4.5	0	5.0	.10	1.8	0
MAX.	6.0	.10	5.0	.40	12.0	1.0	7.7	1.7

SUMMARY BY VARIABLE

Sullivan BK 2A, AM

VARIABLE	Ron S.		June T.		Clarence F.		Robert D.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	10		9		5		17	
MEAN	3.0	.02	5.4	.50	6.1	.18	5.7	.12
ST. DEV.	.50	.04	.50	.50	2.2	.21	2.3	.27
MEDIAN	2.9	0	5.5	.60	5.5	.10	5.0	0
MIN.	2.5	0	3.0	0	4.5	0	2.5	0
MAX.	4.0	.10	8.5	1.2	10.0	.50	11.5	1.0
	Doug B.		Jackie S.		Bobbie R.		Doug B.	
DAYS	3		7		9		6	
MEAN	4.5	.03	2.6	.01	4.1	.10	5.4	.11
ST. DEV.	00	.05	.67	.03	1.0	.10	1.1	.09
MEDIAN	4.5	0	2.8	0	4.0	.10	5.2	.15
MIN.	4.5	0	1.5	0	2.5	0	4.0	0
MAX.	4.5	.10	3.5	.10	5.5	.20	7.0	.20
	Betty H.		Robert M.		Greg E.		Class Average	
DAYS	15		10		10			
MEAN	4.1	.15	6.8	.07	8.2	.42	5.1	.17
ST. DEV.	1.9	.13	2.8	.18	3.4	.31	2.1	.28
MEDIAN	4.0	.10	6.1	0	.30	.30	4.9	.02
MIN.	2.1	0	3.8	0	4.5	.10	2.1	0
MAX.	8.5	.40	13.0	.60	15.0	1.0	11.5	1.2

SUMMARY BY VARIABLE
Sullivan BK 3 A, am

VARIABLE	Alfred B.		Ron S.		June T.		Clara M.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	7		16		6		3	
MEAN	3.4	.00	2.6	.01	3.7	.25	4.5	.000
ST. DEV.	.96	.00	.75	.05	1.9	.61	2.6	.00
MEDIAN	3.7	.00	2.7	.00	4.5	.00	5.5	.00
MIN.	2.0	.00	.90	.00	.5	.00	1.5	.00
MAX.	4.5	.00	3.9	.20	5.5	1.5	6.5	.00
	Robert D.		Doug B.		Bobbie R.		Robert B.	
DAYS	13		6		5		3	
MEAN	4.9	.74	5.6	.18	4.9	.00	5.6	.00
ST. DEV.	2.5	.67	.75	.21	.61	.00	.76	.00
MEDIAN	4.0	.06	5.5	.01	4.9	.00	5.5	.00
MIN.	2.5	.00	5.5	.00	4.5	.00	5.0	.00
MAX.	11.0	2.0	6.5	.60	6.0	.00	6.5	.00
	Betty H.		Robert M.		Greg E.		Class Average	
DAYS	23		11		7			
MEAN	4.0	.00	7.4	.02	9.6	.24	4.5	.19
ST. DEV.	1.2	.02	2.1	.04	1.9	.21	2.0	.43
MEDIAN	4.0	.00	6.5	.00	9.5	.02	4.4	0
MIN.	2.0	.00	5.0	.00	6.0	.00	.5	0
MAX	6.5	.10	12.0	.10	12.0	.60	11.0	2.0

SUMMARY BY VARIABLE

Sullivan BK 4 A, AM

VARIABLE	Ron S.		June T.		Clara M.		Doug B.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error r
DAYS	2		11		4		9	
MEAN	6.2	0	4.3	.18	11.8	.05	7.6	.25
ST. DEV.	2.4	0	1.9	.25	5.7	.01	1.5	.25
MEDIAN	6.2	0	3.8	.00	10.5	.00	6.5	.00
MIN.	4.5	0	2.1	.00	6.5	.00	6.5	.00
MAX.	8.0	0	8.0	.50	20.0	.20	11.0	.70

	Gary W.		Betty H.		Robert M.		Greg E.	
DAYS	4		10		7		6	
MEAN	9.2	.01	6.5	.04	9.8	.10	12.0	.01
ST. DEV	3.5	.08	2.0	.05	1.3	.11	8.0	.04
MEDIAN	8.5	.01	6.5	.00	10.0	.10	10.5	.00
MIN.	6.0	.00	4.0	.00	8.0	0	1.0	.00
MAX.	14.0	.20	11.0	.10	12.0	.30	24.0	.10

	Class Average	
DAYS		
MEAN	7.9	.11
ST. DEV.	4.2	.18
MEDIAN	7.5	0
MIN.	1.0	0
MAX	24.0	.70

SUMMARY BY VARIABLE

Sullivan BK 5 A, am

VARIABLE	June T.		Robert M.		Doug B.		Gary W.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	15		7		6		2	
MEAN	3.7	.05	8.5	.17	6.0	.18	12.0	.04
ST. DEV.	1.0	.064	1.8	.09	2.6	.18	.00	.28
MEDIAN	3.5	.00	9.0	.20	5.5	.20	12.0	.40
MIN.	1.8	.00	6.0	.00	2.5	.00	12.0	.02
MAX.	5.3	2.0	11.0	.30	10.0	.50	12.0	.50

	Robert M.		Greg E.					
DAYS	8		6					
MEAN	7.5	.08	6.4	.01				
ST. DEV.	2.7	.14	2.1	.04				
MEDIAN	7.2	.00	6.5	.00				
MIN.	3.7	.00	3.0	.00				
MAX.	12.0	.40	8.5	.10				

	Class Average							
DAYS								
MEAN	6.2	.25						
ST. DEV.	2.8	.42						
MEDIAN	5.5	.10						
MIN.	1.8	0						
MAX	12.0	2.0						

SUMMARY BY VARIABLE
Sullivan BK6 A, am

VARIABLE	Robert M.		Doug B.		Gary W.		Robert M.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	5		5		8		3	
MEAN	7.1	.12	6.5	.16	7.7	.17	36.	.20
ST. DEV.	1.9	.08	2.2	.08	2.4	.12	51.	.34
MEDIAN	6.5	.10	6.0	.20	7.5	.15	7.0	.00
MIN.	5.0	.00	4.0	.00	4.8	.00	6.0	.00
MAX.	10.0	.20	10.0	.20	12.0	.40	95.5	.60
	Greg E							
DAYS	9							
MEAN	13.1	.02						
ST. DEV.	10.6	.04						
MEDIAN	9.0	0						
MIN.	7.0	0						
MAX.	40.0	.10						
	Class Average							
DAYS								
MEAN	10.6	.12						
ST. DEV.	10.5	.11						
MEDIAN	8.0	.10						
MIN.	4.0	0						
MAX.	51.2	.40						

SUMMARY BY VARIABLE
Sullivan BK 7 A am

VARIABLE	Robert M.		Doug B.		Gary W.		Robert M.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	4		6		5		12	
MEAN	5.6	.02	8.0	.21	4.5	.14	7.7	.05
ST. DEV	1.7	.05	2.1	.14	.87	.08	1.9	.07
MEDIAN	5.2	.00	7.5	.25	4.0	.20	7.5	.00
MIN.	4.0	.00	6.0	.00	4.0	.00	4.5	.00
MAX.	8.0	.10	11.0	.40	6.0	.20	12.0	.20

	Greg E.	
DAYS	11	
MEAN	11.7	.21
ST. DEV.	3.5	.31
MEDIAN	11.0	.10
MIN.	7.5	.00
MAX.	20.0	1.0

	Class Average	
DAYS		
MEAN	8.3	.14
ST. DEV.	3.3	.20
MEDIAN	7.5	.10
MIN.	4.0	0
MAX.	20.0	1.0

SUMMARY BY VARIABLE

Sullivan BK8 A,AM

VARIABLE	Robert M.		Gary W.		Robert M.		Greg E.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error
DAYS	2		5		14		10	
MEAN	5.0	.10	4.5	.14	9.5	.07	8.4	.13
ST. DEV.	2.1	.15	1.0	.11	3.7	.11	1.4	.15
MEDIAN	5.0	.10	5.0	.10	8.5	.00	8.5	.05
MIN.	3.5	.00	3.0	.00	5.0	.00	8.5	.00
MAX.	6.5	.20	5.5	.30	2.0	.30	10.0	.40
DAYS								
MEAN								
ST. DEV.								
MEDIAN								
MIN.								
MAX.								
	Class Average							
DAYS								
MEAN	8.2	.10						
ST. DEV.	3.2	.12						
MEDIAN	7.7	.05						
MIN.	3.5	0						
MAX.	20.0	.40						

SUMMARY BY VARIABLE

VARIABLE	Gary W.		Robert M.		Greg E.			
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error ra
DAYS	4		7		19			
MEAN	4.4	.10	6.4	.10	5.6	.17		
ST. DEV.	1.8	.00	1.1	.12	1.8	.16		
MEDIAN	4.1	.10	6.5	.00	5.1	.20		
MIN.	2.6	.10	4.5	.00	3.0	.00		
MAX.	7.0	.10	8.0	.30	9.0	.50		
DAYS								
MEAN								
ST. DEV.								
MEDIAN								
MIN.								
MAX.								
	Class Average							
DAYS								
MEAN	5.7	.14						
ST. DEV.	1.5	.14						
MEDIAN	5.8	.12						
MIN.	3.0	0						
	8.0	.5						

SUMMARY BY VARIABLE

VARIABLE	Robert B.		Robert B.		Greg E		Greg E.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error
DAYS	5		3		4		2	
MEAN	2.8	.30	9.0	.30	6.8	.95	17.0	.95
ST. DEV.	2.3	.17	2.6	.17	4.5	.07	0	.07
MEDIAN	1.5	.20	10.0	.20	7.5	.95	17.0	.95
MIN.	1.1	.20	6.0	.20	1.2	.90	17.0	.9
MAX.	6.5	.50	11.0	.50	11.0	1.0	17.0	1.0
DAYS								
MEAN								
ST. DEV.								
MEDIAN								
MIN.								
MAX.								
	Class Average		Class Average					
DAYS								
MEAN	3.1	3.1	6.9	1.3				
ST. DEV.	2.3	2.8	3.4	.4				
MEDIAN	2.8	1.7	6.4	1.3				
MIN.	.6	.3	3.5	.7				
MAX.	8.5	10.5	12.2	1.9				

SUMMARY BY VARIABLE

Sullivan BK10 -A, AM

VARIABLE	Robert M.		Greg E.					
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error r
DAYS	11		9					
MEAN	5.7	.13	5.2	.27				
ST. DEV.	1.5	.12	1.3	.16				
MEDIAN	6.5	.10	5.5	.30				
MIN.	2.0	.00	3.0	00				
MAX.	7.0	.40	6.5	.60				
DAYS								
MEAN								
ST. DEV.								
MEDIAN								
MIN.								
MAX.								
	Class Average							
DAYS								
MEAN	5.5	.20						
ST. DEV.	1.2	.15						
MEDIAN	6.0	.20						
MIN.	2.0	0						
MAX.	7.0	.60						

SUMMARY BY VARIABLE

Sullivan AM-Class Averages

VARIABLE	Class Average BK-1		Class Average BK-2		Class Average BK-3		Class Average BK-4	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error
DAYS								
MEAN	4.7	.36	5.1	.17	4.5	.19	7.9	.11
ST. DEV.	1.3	.46	2.1	.28	2.0	.43	4.2	.18
MEDIAN	5.0	.11	4.9	.02	4.4	0	7.5	0
MIN.	1.8	0	2.1	0	.5	0	1.0	0
MAX.	7.7	1.7	11.5	1.2	11.0	2.0	24.0	.70
	Book 5		Book 6		Book 7		Book 8	
DAYS								
MEAN	6.2	.25	10.6	.12				
ST. DEV.	2.8	.42	10.5	.11				
MEDIAN	5.5	.10	8.0	.10				
MIN.	1.8	0	4.0	0				
MAX.	12.0	2.0	51.2	.40				
	Book 9							
DAYS								
MEAN								
ST. DEV.								
MEDIAN								
MIN.								
MAX.								

SUMMARY BY VARIABLE
Sullivan BK1 - P.M.

VARIABLE	Alfred B.		Ron S.		Clarence F.		Patrick C.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error r
DAYS	4		16		6		8	
MEAN	4.5	.00	3.1	.02	4.6	.06	3.4	.01
ST. DEV.	1.3	.00	1.2	.06	1.0	.05	1.1	.03
MEDIAN	4.0	.00	3.0	.00	4.9	.10	3.5	.00
MIN.	3.5	.00	1.0	.00	3.0	.00	2.0	.00
MAX.	6.5	.00	5.5	.20	6.0	.10	5.0	.10
	Col N.		Jackie S.		Bobbie R.		Doug B.	
DAYS	6		6		7		5	
MEAN	3.0	.05	4.1	.05	4.4	.18	5.0	00
ST. DEV.	1.1	.08	1.9	.08	1.5	.18	.63	.00
MEDIAN	2.8	.00	3.6	.00	4.5	.10	5.0	.00
MIN.	1.8	.00	2.7	.00	2.3	.00	4.6	.00
MAX.	5.0	.02	8.0	.20	7.0	.50	5.6	
							Class Average	
DAYS							3.6	.03
MEAN							1.3	.05
ST. DEV.							3.5	0
MEDIAN							1.0	0
MIN.							7.0	.20

SUMMARY BY VARIABLE

Sullivan BK2 B-PM

VARIABLE	Alfred B.		Ron S.		Clarence F.		Patrick C.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error r
DAYS	8		18		4		10	
MEAN	9.2	.01	2.6	.01	4.3	.12	3.5	.00
ST. DEV.	1.6	.03	.83	.03	1.2	.05	1.0	.00
MEDIAN	8.7	.00	2.5	.00	4.2	.10	3.7	.00
MIN.	7.5	.00	1.4	.00	4.0	.10	1.4	.00
MAX.	11.5	.10	4.0	.10	6.0	.20	4.5	

	Doug B.		Jackie S.		Juanita A.		Bobbie R.	
DAYS	3		5		5		4	4
MEAN	4.0	.00	2.7	.06	3.2	.00	4.6	.20
ST. DEV.	.5	.00	.59	.05	2.1	.03	.25	.14
MEDIAN	4.0	.00	2.9	.01	2.9	.00	4.5	.25
MIN.	3.5	.00	1.9	.00	.70	.00	4.5	.00
MAX.	4.5		3.5	.10	12.0	.20	5.0	.30

	Robert B.						Class Average	
DAYS	5						3.5	.01
MEAN	5.1	.06					1.4	.04
ST. DEV.	1.1	.08					3.2	0
MEDIAN	5.0	.00					.8	0
MIN.	4.0	.00					8.0	.20
MAX.	7.0	.20						

SUMMARY BY VARIABLE
Sullivan BK 3B PM

VARIABLE	Alfred B. correct rate	Alfred B. error rate	Ron S. correct rate	Ron S. error rate	Clara M. correct rate	Clara M. error rate	Patrick C. correct rate	Patrick C. error r
DAYS	7		10		3		6	
MEAN	4.4	.05	3.2	.04	6.8	.03	3.8	.05
ST. DEV.	1.8	.07	1.1	.06	2.8	.05	1.0	.08
MEDIAN	4.5	.00	3.8	.00	6.0	.00	3.7	.00
MIN.	2.3	.00	.40	.00	4.5	.00	2.5	.00
MAX.	7.5	.20	4.0	.20	10.0	.10	5.5	.2
	Doug B.		Bobbie R.		Robert B.			
DAYS	5		2		2			
MEAN	6.9	.16	6.7	.00	5.7	.00		
ST. DEV.	.89	.13	.35	.00	.35	.00		
MEDIAN	7.0	.10	6.7	.00	5.7	.00		
MIN.	6.0	.00	6.5	.00	5.5	.00		
MAX.	8.0	.30	7.0	.00	6.0	.00		
							Class	Average
DAYS							4.6	.05
MEAN							1.9	.08
ST. DEV.							4.0	0
MEDIAN							.4	0
MIN.							10.0	.3
MAX.								

SUMMARY BY VARIABLE

Sullivan BK4B PM

VARIABLE	Ron S.		Robert M.		Doug B.		Georgene W.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	2		4		9		4	
MEAN	5.5	.20	12.0	.00	7.6	.48	6.6	.10
ST. DEV.	.07	.0	2.3	.00	3.0	.96	.94	.08
MEDIAN	5.5	.20	12.0	.00	7.0	.10	6.2	.10
MIN.	5.5	.20	10.0	.00	5.0	.00	6.0	.00
MAX.	5.6	.20	14.0	.00	15.0	3.0	8.0	.20
DAYS								
MEAN								
ST. DEV.								
MEDIAN								
MIN.								
MAX.								
							Class Average	
DAYS							8.1	.27
MEAN							3.1	.67
ST. DEV.							7.0	.10
MEDIAN							5.0	0
MIN.							15.0	3.0
MAX.								

SUMMARY BY VARIABLE
Sullivan Bk 5 B PM

VARIABLE	Robert M. correct rate	Robert M. error rate	Doug B. correct rate	Doug B. error rate	Georgene W. correct rate	Georgene W. error rate	Betty H. correct rate	Betty H. error r
DAYS	7		6		2		6	
MEAN	7.8	.12	6.2	.25	8.0	.15	8.5	.01
ST. DEV.	3.8	.13	1.4	.38	.07	.21	1.5	.04
MEDIAN	6.5	.10	5.7	.10	8.0	.15	8.5	.00
MIN.	5.0	.00	5.0	.00	7.5	.00	6.5	.00
MAX.	16.0	.40	9.0	1.0	8.5	.30	10.0	.1c
DAYS								
MEAN								
ST. DEV.								
MEDIAN								
MIN.								
MAX.								
							Class Acc.	g
DAYS								
MEAN							7.4	.13
ST. DEV.							2.5	.23
MEDIAN							6.5	.10
MIN.							5.0	0
MAX.							16.0	1.0

SUMMARY BY VARIABLE
Sullivan Bk 6 B PM

VARIABLE	Robert M. correct rate	Robert M. error rate	Doug B. correct rate	Doug B. error rate	Georgene W. correct rate	Georgene W. error rate	correct rate	error r.
DAYS	4		5		8			
MEAN	6.2	.00	12.1	.14	5.4	.17		
ST. DEV.	1.1	.00	4.2	.14	1.5	.14		
MEDIAN	5.7	.00	13.0	.10	5.7	.15		
MIN.	5.5	.00	7.0	.00	3.0	.00		
MAX.	8.0	.00	17.0	.30	7.0	.40		
DAYS								
MEAN								
ST. DEV.								
MEDIAN								
MIN.								
MAX.								
							Class Average	
DAYS								
MEAN							7.5	.12
ST. DEV.							3.8	.13
MEDIAN							6.5	.10
MIN.							3.0	0
MAX.							17.0	.40

SUMMARY BY VARIABLE
Sullivan BK 7 B PM

VARIABLE	Robert M. correct rate	Robert M. error rate	Doug B. correct rate	Doug B. error rate	Georgene W. correct rate	Georgene W. error rate	correct rate	error ra
DAYS	4		5		5			
MEAN	5.8	,00	5.2	.02	4.1	.06		
ST. DEV.	2.4	.00	.90	.04	1.0	.05		
MEDIAN	4.6	.00	5.0	.00	4.7	.10		
MIN.	4.5	.00	4.0	.00	3.0	.00		
MAX.	9.5	.00	6.5	.10	5.0	.10		
DAYS								
MEAN								
ST. DEV.								
MEDIAN								
MIN.								
MAX.								
							Class Average	
DAYS								
MEAN							4.9	.02
ST. DEV.							1.5	.04
MEDIAN							4.8	0
MIN.							3.0	0
MAX.							9.5	.10

SUMMARY BY VARIABLE
Sullivan Bk 8B PM

VARIABLE	Georgene W. correct rate	Georgene W. error rate	correct rate	error rate	correct rate	error rate	correct rate	error r
DAYS	5							
MEAN	4.9	.10						
ST. DEV.	1.7	.07						
MEDIAN	5.0	.10						
MIN.	2.3	.00						
MAX.	7.0	.20						
DAYS								
MEAN								
ST. DEV.								
MEDIAN								
MIN.								
MAX.								
DAYS								
MEAN								
ST. DEV.								
MEDIAN								
MIN.								
MAX.								

SUMMARY BY VARIABLE

Sullivan PM - Class Averages

VARIABLE	BK1 correct rate	BK1 error rate	BK-2 correct rate	BK-2 error rate	BK-3 correct rate	BK-3 error rate	BK-4 correct rate	BK-4 error r
DAYS								
MEAN	3.6	.03	3.5	.01	4.6	.05	8.1	.27
ST. DEV.	1.3	.05	1.4	.04	1.9	.08	3.1	.67
MEDIAN	3.5	0	3.2	0	4.0	0	7.0	.10
MIN.	1.0	0	.8	0	.4	0	5.0	0
MAX.	7.0	.20	8.0	.20	10.0	.30	15.0	3.0
	BK-5		BK-6					
DAYS								
MEAN	7.4	.13	7.5	.12				
ST. DEV.	2.4	.23	3.8	.13				
MEDIAN	6.5	.10	6.5	.10				
MIN.	5.0	0	3.0	0				
MAX.	16.0	1.0	17.0	.40				
DAYS								
MEAN								
ST. DEV.								
MEDIAN								
MIN.								
MAX.								

SUMMARY BY VARIABLE

VARIABLE	Suppes Book 1 - Baseline		Suppes Book 2 Intervention		Suppes Book 1 - Baseline		Suppes Book 1 Interventio	
					Doug B.		Doug B.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	9	9	20	20	12	12	25	25
MEAN	2.1	.12	2.6	..13	9.7	.17	6.8	.18
ST. DEV.	.9	.10	1.9	.26	6.5	.20	3.1	.25
MEDIAN	2.3	.10	1.8	.00	6.5	.10	6.5	.10
MIN.	.5	.00	.2	.00	4.0	.00	1.1	.00
MAX.	3.5	.3	7.0	1.0	22.5	.7	12.0	.80
	Gary W.		Gary W.		Julie W.		Julie W.	
DAYS	25	25	9	9	8	8	33	33
MEAN	6.1	.08	8.5	.01	2.8	.5	1.3	.18
ST. DEV.	3.6	.12	3.2	.03	1.0	.14	1.3	.22
MEDIAN	5.5	.10	9.0	.00	2.6	.10	1.0	.2
MIN.	2.0	.00	4.8	.00	1.5	.00	.1	.00
MAX.	18.0	.6	13.0	1.0	4.5	.4	4.6	1.0
	Jackie S.		Jackie S.					
DAYS	6	6	18	18				
MEAN	3.6	.21	2.4	.13				
ST. DEV.	1.6	.20	1.5	.17				
MEDIAN	3.5	.20	1.9	.10				
MIN.	2.0	.20	.6	.00				
MAX	6.0	.60	6.5	.7				

SUMMARY BY VARIABLE

VARIABLE	Suppes Book 1 - Baseline		Suppes Book 1 Intervention		Suppes Book 1 - Baseline		Suppes Book 1 Intervention	
	Alfred B.		Alfred B.		Ron S.		Ron S.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	5	5	21	21	5	5	18	18
MEAN	3.7	.1	4.7	.09	2.9	.02	4.7	.0
ST. DEV.	1.5	.0	1.7	.15	1.6	.04	2.4	.1
MEDIAN	4.0	.0	4.5	.00	3.0	.00	4.0	.0
MIN.	1.0	.1	1.5	.00	1.0	.00	2.0	.0
MAX.	5.0	.1	8.0	.50	4.5	.10	10.0	.7
	Clarence F.		Clarence F.		Arvel M.		Arvel M.	
DAYS	5	5	15	15	7	7	28	28
MEAN	5.4	.2	6.4	.39	3.0	.14	3.6	.0
ST. DEV.	3.2	.18	3.0	1.0	1.8	.11	2.5	.1
MEDIAN	6.5	.1	6.0	.1	3.7	.2	3.0	.0
MIN.	.2	.00	3.8	.0	.4	.00	.5	.0
MAX.	8.5	.40	15.0	4.0	5.0	.30	12.0	.7
	Robert M.		Robert M.		Robert D.		Robert D.	
DAYS	6	6	16	16	8	8	24	24
MEAN	4.6	.05	5.5	.06	3.4	.13	3.8	.06
ST. DEV.	3.5	.08	3.4	.17	1.7	.18	1.6	.12
MEDIAN	4.0	.00	5.5	.00	2.6	.05	3.5	.00
MIN.	1.1	.00	1.0	.00	1.6	.00	1.8	.00
MAX	10.0	2.00	15.0	.6	6.5	5.0	8.0	.4

SUMMARY BY VARIABLE

VARIABLE	Suppes Book 1 - AM		Suppes Book 1 - PM		Suppes Book 2 - AM		Suppes Book 2 - PM	
	Gary W.		Gary W.		Gary W.		Gary W.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	8		7		45		28	
MEAN	8.8	.12	8.9	.17	6.7	.05	6.1	.08
ST. DEV.	4.8	.20	4.5	.11	3.8	.08	3.3	.12
MEDIAN	6.7	.05	9.0	.20	.6	.00	5.2	.00
MIN.	.50	.00	3.7	.00	.2	.00	2.5	.00
MAX.	18.0	.6	18.0	.30	23.0	.30	20.0	.50
	Coe N.		Coe N.		Coe N.		Coe N.	
DAYS	29		27		38		23	
MEAN	3.8	.08	3.5	.10	3.3	.00	5.0	.01
ST. DEV.	1.4	.14	1.7	.25	1.4	.03	3.7	.04
MEDIAN	3.6	.00	3.0	.00	3.3	.00	4.0	.00
MIN.	1.9	.00	.9	.00	.1	.00	1.0	.00
MAX.	8.0	.60	7.5	1.0	6.0	.20	16.0	.20
	Jackie S.		Jackie S.		Jackie S.		Jackie S.	
DAYS	44		36		91		54	
MEAN	6.2	.37	3.8	.13	3.6	.07	4.8	.09
ST. DEV.	3.9	.49	3.0	.16	2.3	.11	3.3	.23
MEDIAN	5.6	.20	2.9	.10	3.0	.00	3.8	.00
MIN.	.4	.00	.6	.00	0.4	.00	1.0	.00
MAX.	21.0	2.7	15.0	.50	14.0	.08	20.0	.15

SUMMARY BY VARIABLE

VARIABLE	Suppes Book 1 AM		Suppes Book 1 - PM		Suppes Book 2 - AM		Suppes Book 2 - PM	
	Patrick C.		Patrick C.		Patrick C.		Patrick C.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	45		34		28		12	
MEAN	2.7	.09	2.7	.05	3.2	.00	3.2	.02
ST. DEV.	1.6	.19	1.4	.12	3.1	.02	2.3	08
MEDIAN	2.3	.00	2.6	.00	4.0	.00	2.9	.00
MINIMUM	.2	.00	.7	.00	1.5	.60	.3	.00
MAXIMUM	7.0	.10	7.0	.60	6.5	.10	9.0	.30
	Robert D.		Robert D.		Robert D.		Robert D.	
DAYS								
MEAN								
ST.DEV.								
MEDIAN								
MINIMUM								
MAXIMUM								
	Doug B.		Doug B.		Doug B.		Doug B.	
DAYS								
MEAN	6.2	.17	8.3	.15	7.5	16	8.3	.09
ST.DEV.	2.6	.14	4.6	.21	3.5	.25	4.5	14
MEDIAN	5.5	.10	5.5	.05	7.2	.00	7.0	.00
MINIMUM		.00	4.0	.00		.00	2.0	.00
MAXIMUM	12.0	5	17.0	.70	15.00	.50	40.0	.60

SUMMARY BY VARIABLE

VARIABLE	Suppes Book 1 - AM		Suppes Book 1 - PM		Suppes Book 2 - AM		Suppes Book 2 - PM	
	Arvel M.		Arvel M.		Arvel M.		Arvel M.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	33		28		37		27	
MEAN	3.6	.08	3.9	.07	4.9	.03	3.4	.02
ST. DEV.	2.4	.14	2.7	.11	3.1	.08	2.2	.05
MEDIAN	3.3	.00	2.8	.00	4.0	.00	3.0	.00
MIN.	.4	.00	.9	.00	1.3	.00	.7	.00
MAX.	12.0	.7	12.0	.40	15.0	.40	9.0	.20
	Robert M.		Robert M.		Robert M.		Robert M.	
DAYS	22		22		37		38	
MEAN	5.9	.06	5.5	.06	8.1	.01	7.2	.03
ST. DEV.	3.2	.10	3.2	.10	4.2	.05	2.9	.07
MEDIAN	4.5	.00	5.0	.00	7.5	.00	7.0	.00
MIN.	1.1	.00	1.0	.00	2.5	.00	2.0	.00
MAX.	15.0	.6	16.0	.30	19.0	.20	14.0	.20
	Clarence F.		Clarence F.		Clarence F.		Clarence F.	
DAYS	21		16		42		26	
MEAN	6.1	.32	5.9	.23	7.1	.03	7.3	.00
ST. DEV.	2.9	.85	3.1	.26	4.0	.10	4.7	.02
MEDIAN	6.0	.10	5.7	.20	6.0	.00	6.5	.00
MIN.	.2	.00	2.0	.00	.20	.00	2.0	.00
MAX.	15.0	.40	13.0	1.0	18.0	.60	25.0	.10

SUMMARY BY VARIABLE

VARIABLE	Suppes Book 1 - AM		Suppes Book 1 - PM		Suppes Book 2 - AM		Suppes Book 2 - PM	
	Alfred B.		Alfred B.		Alfred B.		Alfred B.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	26		27		37		24	
MEAN	4.5	.08	3.5	.09	5.3	.00	4.6	.03
ST. DEV.	1.7	.14	1.5	.19	2.8	.02	1.6	.09
MEDIAN	4.5	.00	3.0	.00	5.0	.00	4.5	.00
MIN.	1.0	.00	.9	.00	1.5	.00	1.9	.00
MAX.	8.0	.5	6.5	.90	17.0	.10	8.0	.40
	Ron S.		Ron S.		Ron S.		Ron S.	
DAYS	29		25		32		24	
MEAN	4.3	.06	3.3	.04	7.8	.01	4.3	.02
ST. DEV.	2.2	.16	2.1	.10	3.9	.04	2.7	.08
MEDIAN	3.9	.00	3.2	.00	7.0	.00	3.5	.00
MIN.	1.0	.00	..5	.00	2.9	.00	.2	.00
MAX.	10.0	.7	7.5	.40	18.0	.20	11.0	.40
	June T.				June T.			
DAYS	20				49			
MEAN	5.8	.03			6.2	.14		
ST. DEV.	3.7	.13			3.6	.44		
MEDIAN	4.5	.00			5.5	.00		
MIN.	1.6	.00			1.4	.00		
MAX.	14.0	.60			20.0	2.00		

SUMMARY BY VARIABLE

VARIABLE	Suppes Book 1 - AM				Suppes Book 2 - AM			
	Robert M.				Robert M.			
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	26				29			
MEAN	8.0	.32			5.6	.43		
ST. DEV.	4.6	.45			3.7	.42		
MEDIAN	8.0	.20			5.5	.30		
MIN.	.7	.00			1.3	.00		
MAX.	22.0	2.0			20.0	2.20		
	Greg E.				Greg E.			
DAYS	24				31			
MEAN	1.0	.38			6.4	.39		
ST. DEV.	7.3	.62			4.6	.38		
MEDIAN	8.7	.20			5.5	.30		
MIN.	.5	.00			1.5	.00		
MAX.	29.0	3.0			25.00	1.50		
	Steve N.				Steve N.			
DAYS	29				29			
MEAN	4.7	.03			2.6	.01		
ST. DEV.	4.3	.07			1.2	.05		
MEDIAN	3.5	.00			2.8	.00		
MIN.	.4	.00			.6	.00		
MAX.	22.0	.20			6.0	.30		

SUMMARY BY VARIABLE

VARIABLE	Suppes Book 1 - AM		Suppes Book 1 - PM		Suppes Book 2 - AM		Suppes Book 2 - PM	
	Doug B.				Doug B.		Doug B.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	46				29		49	
MEAN	4.4	.20			3.6	.17	3.4	.07
ST. DEV.	3.8	.32			2.5	.19	1.7	.10
MEDIAN	4.2	.20			2.8	.10	3.0	.00
MIN.	.10	.00			.7	.00	.7	.00
MAX.	25.00	2.0			12.0	.70	10.0	.50
	Betty H.				Betty H.		Betty H.	
DAYS	30				38		31	
MEAN	5.4	.22			4.0	.18	4.1	.01
ST. DEV.	3.4	.39			2.7	.23	2.1	.24
MEDIAN	4.5	.10			3.0	.10	3.9	.10
MIN.	1.0	.00			1.0	.00	1.0	.00
MAX.	15.5	2.0			15.0	1.00	8.5	.10
	Julie H.				Julie H.		Julie H.	
DAYS	34		26		16		31	
MEAN	2.6	.10	2.8	.11	3.8	.04	3.1	.02
ST. DEV.	1.0	.14	1.2	.20	2.0	.08	1.6	.05
MEDIAN	2.5	.10	2.4	.05	3.6	.00	3.0	.00
MIN.	1.0	.00	1.0	.00	1.2	.00	1.0	.00
MAX.	5.5	.6	6.0	1.0	10.0	.40	8.5	.20

SUMMARY BY VARIABLE

VARIABLE	Suppes Book 1 - AM				Suppes Book 2 - AM		Suppes Book 2 - PM	
	Juanita A.				Juanita A.		Juanita A.	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
DAYS	53				38			
MEAN	2.5	.08			2.1	.06		
ST. DEV.	1.6	.16			1.4	.12		
MEDIAN	2.0	.00			1.9	.00		
MIN.	.20	.00			.4	.00		
MAX	7.0	.7			7.0	.50		
	Julie W.				Julie W.		Julie W.	
DAYS	94				71		44	
MEAN	2.6	.24			2.8	.09	2.5	.05
ST. DEV.	2.2	.37			1.7	.13	1.3	.08
MEDIAN	1.8	.20			2.5	.00	2.2	.00
MIN.	.5	.00			.5	.00	.5	.00
MAX	12.5	2.5			8.0	.60	5.5	.30
	Bobby R.				Bobby R.		Bobby R.	
DAYS	28				23		63	
MEAN	3.0	.30			2.7	.16	3.0	.01
ST. DEV.	1.9	.33			1.4	.15	1.6	.03
MEDIAN	3.0	.20			2.0	.10	2.9	.00
MIN.	.40	.00			.2	.00	.8	.00
MAX	8.5	1.0			6.0	.60	10.0	2.50

SUMMARY BY VARIABLE

VARIABLE	Suppes Book 1 - AM		Suppes Book 1 - PM		Suppes Book 2 - AM		Suppes Book 2 - AM	
	Class Average		Class Average		Class Average		Class Average	
	correct rate	error rate	correct rate	error rate	correct rate	error rate	correct rate	error rate
YS								
AN								
. DEV.								
DIAN								
N.								
X.								
YS								
AN								
. DEV.								
DIAN								
N.								
X.								
AYS								
AN	3.4	.13	3.8	.09	4.5	.08	4.7	.05
T. DEV.	2.8	.13	1.3	.01	1.7	.08	1.9	.08
EDIAN	3.2	.10	3.6	.05	4.4	.07	4.3	.03
IN.	.5	.00	1.5	.00	1.2	.00	1.7	.00
X.		.50	8.5	1.0	13.3	.42	15.0	.46

Book-1 mean correct (AM + PM) = 3.6
Book-1 mean error rate (AM + PM) = .11

Book-2 mean correct (AM + PM) = 4.6
Book-2 mean error rate (AM + PM) = .06

APPENDIX E

WIDE RANGE ACHIEVEMENT TEST SCORES

APPENDIX E

WIDE RANGE ACHIEVEMENT TEST SUMMARY: $\bar{x}$ Differences.

SCHOOL	GRADE PLACEMENT pre = $\bar{x}^1$ post = $\bar{x}^2$	O/O ILE pre = $\bar{x}^1$ post = $\bar{x}^2$
McCarver (Experimental)	R $\bar{x}^2 - \bar{x}^1 = 1.40$	R $\bar{x}^2 - \bar{x}^1 = 6.86$
	S. $\bar{x}^2 - \bar{x}^1 = 0.27$	S $\bar{x}^2 - \bar{x}^1 = -.23$
	M $\bar{x}^2 - \bar{x}^1 = 1.04$	M $\bar{x}^2 - \bar{x}^1 = 3.61$
Lister (Experimental)	R $\bar{x}^2 - \bar{x}^1 = 0.89$	R $\bar{x}^2 - \bar{x}^1 = 7.05$
	S $\bar{x}^2 - \bar{x}^1 = 0.47$	S $\bar{x}^2 - \bar{x}^1 = 0.09$
	M $\bar{x}^2 - \bar{x}^1 = 1.76$	M $\bar{x}^2 - \bar{x}^1 = 6.00$
Bryant (Control)	R $\bar{x}^2 - \bar{x}^1 = 0.26$	R $\bar{x}^2 - \bar{x}^1 = -.31$
	S $\bar{x}^2 - \bar{x}^1 = 0.61$	S $\bar{x}^2 - \bar{x}^1 = 0.81$
	M $\bar{x}^2 - \bar{x}^1 = 0.37$	M $\bar{x}^2 - \bar{x}^1 = 0.20$
Edison I (Control)	R $\bar{x}^2 - \bar{x}^1 = -.90$	R $\bar{x}^2 - \bar{x}^1 = 0.20$
	S $\bar{x}^2 - \bar{x}^1 = 0.05$	S $\bar{x}^2 - \bar{x}^1 = 2.38$
	M $\bar{x}^2 - \bar{x}^1 = -.24$	M $\bar{x}^2 - \bar{x}^1 = -.48$
Edison II (Control)	R $\bar{x}^2 - \bar{x}^1 = 0.06$	R $\bar{x}^2 - \bar{x}^1 = .50$
	S $\bar{x}^2 - \bar{x}^1 = .55$	S $\bar{x}^2 - \bar{x}^1 = 1.33$
	M $\bar{x}^2 - \bar{x}^1 = .48$	M $\bar{x}^2 - \bar{x}^1 = .83$
Experimental	R $\bar{x}_2 - \bar{x}_1 = 1.14$	R $\bar{x}_2 - \bar{x}_1 = 6.95$
	S $\bar{x}^2 - \bar{x}^1 = .37$	S $\bar{x}^2 - \bar{x}^1 = .07$
	M $\bar{x}^2 - \bar{x}^1 = 1.40$	M $\bar{x}^2 - \bar{x}^1 = 4.80$
Control	R $\bar{x}^2 - \bar{x}^1 = -.19$	R $\bar{x}^2 - \bar{x}^1 = .13$
	S $\bar{x}^2 - \bar{x}^1 = .40$	S $\bar{x}^2 - \bar{x}^1 = 1.50$
	M $\bar{x}^2 - \bar{x}^1 = .20$	M $\bar{x}^2 - \bar{x}^1 = .18$

R = Reading
S = Spelling
M = Math

INDIVIDUAL SCORES

SCHOOL: LISTER WIDE RANGE ACHIEVEMENT TEST RESULTS

INITIALS	BIRTHDATE		GRADE PLACEMENT pre	GRADE PLACEMENT post	O/O ILE pre	O/O ILE post
J.S.	61-3-1	R	1.4	2.2	3	6
		S	1.3	1.7	2	4
		M	2.1	2.8	6	12
D.S.	60-4-4	R	1.3	2.1	2	2
		S	1.3	1.7	2	1
		M	1.6	4.2	4	18
J.A.	60-4-23	R	KG3	1.1	1	1
		S	1.0	1.3	2	1
		M	KG7	3.0	1	6
G.W.	60-4-15	R	KG4	1.2	1	1
		S	P.K.9	1.1	.6	1
		M	KG4	2.8	1	5
J.W.	60-8-23	R	KG8	1.6	2	1
		S	1.2	1.3	3	1
		M	1.2	2.6	3	4
B.R.	61-4-23	R	1.2	1.7	4	4
		S	PK7	1.7	2	4
		M	1.8	2.8	10	12
R.B.	60-8-9	R	1.4	2.6	3	4
		S	1.4	1.7	3	1
		M	1.4	3.2	3	8
B.H.	59-9-18	R	1.5	2.2	3	2
		S	1.3	1.8	2	1
		M	2.6	4.5	9	16
J.H.	60-4-12	R	1.6	2.1	3	2
		S	1.3	2.0	2	2
		M	1.2	2.8	2	5
B.M.	59-6-17	R	2.4	3.8	3	9
		S	2.0	2.6	2	3
		M	2.6	4.2	4	13
G.E.	59-5-21	R	2.0	3.5	2	9
		S	2.3	3.0	3	3
		M	2.2	4.2	3	13
S.N.		R	1.4	1.3	3	1
		S	1.3	1.6	2	1
		M	1.9	3.0	5	6

R = Reading
M = Math
S = Spelling

INDIVIDUAL SCORES

SCHOOL: McCarver WIDE RANGE ACHIEVEMENT TEST RESULTS

INITIALS	BIRTHDATE		GRADE PLACEMENT pre	GRADE PLACEMENT post	G/G ILE pre	G/G ILE post
A.B.	59-12-5	R	1.5	2.4	1	3
		S	1.4	1.5	1	1
		M	1.6	2.6	1	4
R.S.	60-3-30	R	1.6	2.5	3	4
		S	1.6	2.0	3	2
		M	1.8	3.9	4	14
J.T.	59-9-12	R	1.9	5.0	2	21
		S	2.2	2.6	3	3
		M	3.2	3.9	7	9
A.M.	59-5-12	R	KG7	1.8	.7	1
		S	1.2	1.2	1	.6
		M	1.6	2.4	1	1
C.M.	59-1-29	R	3.0	4.7	4	12
		S	2.7	2.6	3	2
		M	2.4	3.2	2	3
C.F.	60-5-5	R	1.4	2.8	2	5
		S	1.4	1.4	2	1
		M	2.2	2.4	6	3
R.D.	60-6-4	R	2.2	4.5	6	23
		S	1.7	2.0	4	2
		M	1.8	2.8	4	5
P.C.	58-12-27	R	1.6	2.4	1	1
		S	1.5	1.6	1	.9
		M	1.2	2.4	2	3
D.B.	59-11-6	R	2.0	2.7	2	3
		S	1.7	2.7	1	3
		M	2.1	4.2	1	3
G.W.	59-2-25	R	2.6	4.4	4	21
		S	2.5	3.0	4	6
		M	2.2	3.9	3	14
C.N.	61-12-30	R	1.3	1.8		
		S	1.4	1.6		
		M	2.4	2.2		

R = Reading
S = Spelling
M = Math

INDIVIDUAL SCORES

SCHOOL: Edison I WIDE RANGE ACHIEVEMENT TEST RESULTS

INITIALS	BIRTHDATE		GRADE PLACEMENT pre	GRADE PLACEMENT post	O/O ILE pre	O/O ILE post
A.S.	59-12-25	R	2.5	3.3	4	8
		S	1.6	2.5	1	4
		M	2.4	2.2	3	3
J.K.	58-12-5	R	1.1	2.2	1	1
		S	1.6	1.6	1	.9
		M	2.6	3.4	3	4
J.M.	60-5-9	R	2.0	2.5	5	4
		S	1.5	2.0	3	2
		M	1.9	2.8	4	5
R.G.	60-9-13	R	1.5	2.1	3	2
		S	1.5	2.5	3	4
		M	2.2	2.4	6	3
E.S.	59-5-10	R	2.1	2.2	2	1
		S	1.2	2.2	1	1
		M	1.9	1.2	2	6
H.G.		R	2.1	1.7		
		S	1.8	1.8		
		M	1.9	1.9		

R = Reading
S = Spelling
M = Math

INDIVIDUAL SCORES

SCHOOL: EDISON II WIDE RANGE ACHIEVEMENT TEST RESULTS

INITIALS	BIRTHDATE		GRADE PLACEMENT pre	GRADE PLACEMENT post	O/O ILE pre	O/O ILE post
L.C.	61-12-15	R	KG8	1.7	2	6
		S	KG8	1.5	2	5
		M	KG9	1.8	3	7
G.M.	61-2-14	R	2.1	2.9	6	13
		S	1.8	2.5	5	8
		M	1.2	2.1	2	5
D.R.	61-2-14	R	1.5	2.0	3	5
		S	1.4	2.3	3	7
		M	2.1	2.4	6	7
D.T.	62-6-15	R	1.2	1.6	6	7
		S	1.2	1.3	6	5
		M	1.2	1.8	6	10
D.K.	61-7-5	R	1.5	2.3	5	8
		S	1.5	2.0	5	6
		M	2.6	2.8	18	14
M.M.	61-5-15	R		1.9		4
		S	1.1	1.8	3	4
		M		1.6		3
G.S.	60-10-17	R	2.4	2.7	7	5
		S	2.2	2.6	6	4
		M	2.2	2.2	6	3

R = Reading
S = Spelling
M = Math

INDIVIDUAL SCORES

SCHOOL: BRYANT WIDE RANGE ACHIEVEMENT TEST RESULTS

INITIALS	BIRTHDATE		GRADE PLACEMENT pre	GRADE PLACEMENT post	G/O ILE pre	G/O ILE post
D.M.	59-11-5	R	2.1	2.1	2	2
		S	1.8	2.2	2	2
		M	2.4	2.6	7	3
D.A.	60-8-5	R	2.1	2.0	5	2
		S	1.8	2.5	4	4
		M	1.8	1.9	4	2
G.B.	59-6-15	R	2.9	3.3	4	5
		S	2.7	3.5	5	7
		M	3.0	3.9	6	9
L.S.	59-4-13	R	1.8	2.1	1	1
		S	1.4	2.6	1	2
		M	3.0	3.6	4	5
P.P.	60-2-3	R	1.7	2.0	1	2
		S	1.7	2.7	1	5
		M	3.9	4.5	16	21
D.K.	60-3-7	R	K.6.9	1.6	.8	1
		S	1.1	1.4	2	1
		M	1.9	1.8	4	2
K.K.	60-7-2	R	1.5	1.9	3	2
		S	1.4	1.5	2	1
		M	1.0	1.6	1	1
L.C.	58-4-23	R	5.1	4.7	13	9
		S	3.0	3.5	2	4
		M	3.6	3.9	4	5
R.H.	58-7-31	R	1.8	2.4	1	1
		S	1.7	2.5	.9	1
		M	1.9	2.4	1	1
S.S.	59-12-28	R	2.7	3.1	5	7
		S	2.6	2.9	4	5
		M	1.4	1.4	1	1

R = Reading
S = Spelling
M = Math